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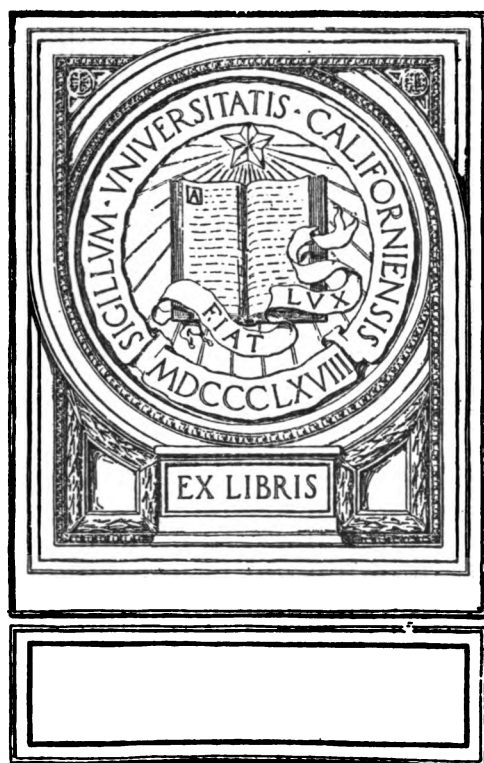
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8

INSTRUCTIONS
TO
OF THE SIGNAL SERVICE,
AND STATES ARMY

1881



INSTRUCTIONS

TO

OBSERVERS

OF

THE SIGNAL SERVICE,

UNITED STATES ARMY.

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1881.

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to you
associated

[Signal Service Orders. 51.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., July 8, 1881.

The revision of "Instructions to Observers of the Signal Service, U. S. Army," pursuant to orders from the Chief Signal Officer of the Army by—

First Lieutenant H. H. C. Dunwoody, Fourth Artillery, acting signal officer and assistant,

First Lieutenant Robert Craig, Fourth Artillery, acting signal officer and assistant,

First Lieutenant Charles E. Kilbourne, Second Artillery, acting signal officer and assistant,
are adopted and will be strictly observed.

These replace all former editions and amendatory orders up to and including June 14, 1881.

W. B. HAZEN,
Brig. & Bvt. Maj. General,
Chief Signal Officer of the Army.

INSTRUCTIONS.

1. Each observer ordered to establish a new station will, upon arriving at the station, immediately proceed to secure a room suitable for office purposes and the storage of instruments and other United States property in his charge. This room must be in the immediate vicinity of the telegraph office charged with the transmission and receipt of the weather reports, and should be in the upper story of a building, and contain at least *one* window facing the north. In all cases he will endeavor to get permission to occupy the roof of this building for the necessary exposure of his instruments, and, at stations specially designated by the Chief Signal Officer, for the erection of an instrument shelter, in accordance with plans furnished by this Office.

2. A lease of this room for a period of one year will be made in case the owner insists upon it, with the privilege of renewal on the part of this Office, in accordance with the regular form to be furnished the observer, on application to the property and disbursing officer. The lease will be made out by the owner of the building or his authorized agent, and forwarded to this Office, for the signature of the proper officer, at as early date as practicable.

3. When permission to occupy the roof for exposure of instruments cannot be obtained, or a suitable roof cannot be found, and at all stations not specially authorized to construct a shelter on the roof, the instrument shelter will be constructed substantially as follows (Fig. 1):

Select a window fronting the north; remove the lattice blinds, if there be any, and along the exterior jambs of the window place perpendicularly two pieces of lattice work (*a, b, a', b'*), projecting to a distance of from twenty to twenty-four inches from the panes. Midway between the window and the outer wall of shelter, and at the height of the eye of

Fig. 1.

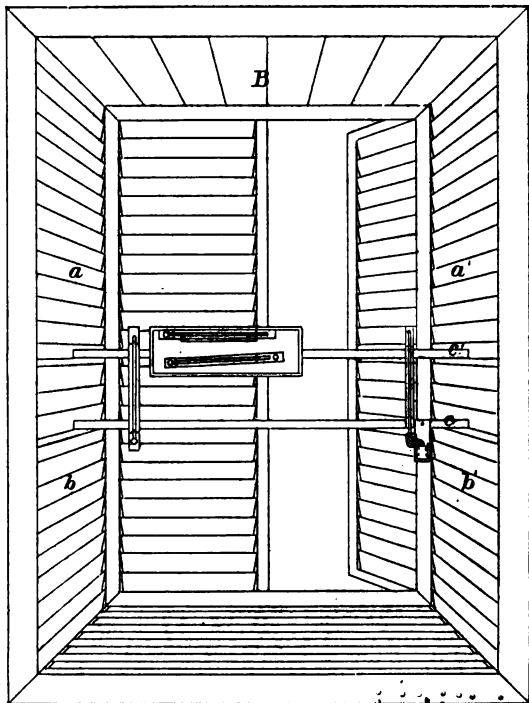


Fig. 1.

the observer, pass from one end of the shelter to the other two small wooden transverse bars (c, c'), each an inch square, for the purpose of supporting the instruments: exposed thermometer on the left, maximum and minimum thermometers in the center, and wet bulb thermometer on the right. The blinds that were removed from the jambs, or others provided for the purpose, will be hinged to the side walls, so as to be opened, when necessary, and secured in the middle by an ordinary staple and hook. Ten inches outside of this frame work a second wall, also of lattice work, will be placed, with the front opening in the center, in the same manner as the inner wall. The whole will be covered with an inclined roof of boards (B), placed at least fifteen or twenty inches above the instruments. The bottom of the shelter will be covered with slats two inches wide, placed one inch apart. The outside of the shelter will be painted with white lead. If the shelter is placed upon the roof, the door must face the north.

4. The building selected should be detached from other buildings, and, when this cannot be had, should be higher than those surrounding it. Too much attention cannot be given to the proper setting up of the instruments and their protection from local influences. The location of the office thus selected must be reported to this Office, and also to the manager of the telegraph office charged with the transmission and receipt of the reports.

5. Immediately after placing his instruments in position, each observer will make out and forward to this Office, a full report in writing, stating the kind, size, and position of room selected; the street and number of the building in which the room is situated; the position of each instrument, and its height above the ground, and also above the benchmark furnished by this Office. In giving the height of the barometer, the measurement will be made to the surface of the mercury in the cistern. Whenever the position of any instrument is changed, which must not be done without good and sufficient cause, a record will be made of such change, with date and amount of difference in elevation; and the facts reported at once to this Office.

In addition to this information, such other facts will be stated as will enable the Chief Signal Officer to judge of the manner in which this part of the observer's duty has been performed.

6. An observer, upon opening a new station, will, as soon as practicable, put himself in communication with the board of trade, chamber of commerce, or board of underwriters, and such other bodies as may desire to co-operate with this office in its efforts to make the service locally, as well as generally, useful. If meteorological committees have not been appointed by any or all of these bodies, their appointment should be urged as a matter of special importance, and the committees requested to place themselves in communication with the Chief Signal Officer. He will also communicate with such colleges, scientific associations, and other institutions of learning as may be located at or near his station, and will explain to their officers and members the nature and object of his duties, and invite their co-operation. He must constantly bear in mind that he is expected to use every effort in his power to render his office of the greatest public utility.

7. The office furniture will be of the plainest kind, and consist only of such articles as are absolutely necessary for the proper transaction of business. (See Par. 226.) The room, furniture, and instruments must be kept neat and clean at all times, and always prepared for inspection.

8. The regular observations from
commence with the morning observation of

and on and after that date five complete observations and a sunset observation will be taken daily. These observations will be recorded in the "Original Record of Observations" (Form 101) and the book of "Monthly Meteorological Report" (Form 113 A).

9. The observations forming the telegraphic series must be taken daily at a. m., p. m., and p. m., local time, (corresponding with 7 a. m., 3 p. m., and 11 p. m., Washington time), and, after the proper corrections have been made, must be written on Form 203, if the station is a telegraphic one, and also in the Record of Bulletins (where this is authorized). The 11 a. m. and 7 p. m. (Washington time) series of observations will be taken at m. and m., local time. When the 11 a. m. or 7 p. m. report is called for by telegraph from the central office, a full report must be sent consisting of the corrected barometer reading, temperature, dew point, direction of wind, and state of weather; velocity of wind, in miles, per hour; maximum velocity of wind, in miles per hour, since last telegraphic observation; upper clouds; lower clouds and the reading of the maximum thermometer, the whole being sent in the regular cipher words, the word to express the maximum velocity since last telegraphic report being taken from the column of words beginning with the letter I. Rainfall will not be sent at these reports. In sending the maximum temperature at time of observation, the cipher words on page 32 of the cipher book will be used. At stations that do not report by telegraph, Form 203 will not be used.

10. The instruments will be read in the following order:

- | | | |
|------------------|-------------------|----------------|
| 1. Barometer. | 3. Wet bulb ther. | 5. Anemoscope. |
| 2. Exposed ther. | 4. Anemometer. | 6. Rain-gauge. |

The maximum and minimum thermometers will always be read after the exposed thermometer. After the instruments have been read the character of the clouds and state of weather will be noted.

11. The readings of the different instruments and character of clouds and state of weather must be entered in the Original Record of Observations as soon as made, and *not* copied in afterward from a slip of paper. Observers will habitually carry this book when making an observation, and enter the readings in *pencil*, as noted at the time. They will also enter the proper corrections, as indicated by the marginal references. Pen and ink must *not* be used for entering any observation or correction. In filling up that portion of the Original Record of Observations which comes under the head of "Weather," the *local* time will be entered.

12. At telegraphic stations the reports will be handed by the observer, or his assistant, in person to the telegraph official charged with the receipt of messages. The reports of station at a. m., at p. m., and at p. m., local time. The 11 a. m. or 7 p. m. report (Washington time), when sent by telegraph, will be filed as soon as practicable after the observation has been made. Stations on the sea-coast telegraph line will forward the 11 a. m. report regularly to this Office by telegraph.

13. Observers must be at the telegraph office from which their reports are sent, with the reports carefully and plainly written out (*manifolded*) *in duplicate*, on Form 203, ten minutes before the hours named above, in order that the operator may be notified in time to prepare for their transmission. The signature of the operator must be obtained to *both* copies of each report, with the exact local time of receipt by him. The manager of the telegraph office from which the reports are sent will be furnished

by the observer with a plainly written or printed list of stations from which reports are to be received at, and also of those to be sent from, his office, with the names of the stations to which they are to be sent. If reports are to be transferred or selected for transfer at any station, an observer on duty at that station must personally attend to such transfer or selection, unless prevented by sickness or other extraordinary cause. To provide against such an event, he must so arrange with the manager that the regular transmission of reports will not be interrupted by his absence.

14. The following is a list of Signal Service stations:

Station.	Station.	Station.
Abraham Lincoln, (Fort), Dak. ○	Decatur, Tex. ×	Logansport, Ind. ○ △
Albany, N. Y. × △	Deer Lodge, Mont. † ○	Los Angeles, Cal. ×
Alexander, (Fort), Alaska. †	Delaware Breakwater, Del. × § =	Louisville, Ky. × ¶
Almota, Wash. † ○	Denison, Tex. ×	Lynchburg, Va. ×
Alpena, Mich. × § =	Denver, Colo. ×	Lytton, British Columbia. †
Apache, (Fort), Ariz. ×	Des Moines, Iowa. × △	Macon, (Fort), N. C. × =
Apache Pass, Ariz. ○	Detroit, Mich. × § = △	Madison, Wis. ×
Assiniboine, (Fort), Mont. ×	Dodge City, Kans. ×	Maricopa, Ariz. ×
Atlanta, Ga. × =	Dos Cabezas, Ariz. ○	Marquette, Mich. × § =
Atlantic City, N. J. × §	Dubuque, Iowa. × ¶	Mason, Tex. ×
Atka, Alaska. †	Duluth, Minn. × § =	Maxio, Ariz. ○
Augusta, Ga. × ¶ §	Eagle Pass, Tex. ×	McKavett, (Fort), Tex. ×
Baltimore, Md. × § =	Eastport, Me. × § =	Moade, (Fort), Dak. † ○
Bangor, Me. ○ △	Edinburg, Tex. ×	Memphis, Tenn. × ¶ △
Barbadoes, W. I. ×	Elliott, (Fort), Tex. ×	Miles City, Mont. ○
Barnegat, N. J. × =	Ellis, (Fort), Mont. ○	Milwaukee, Wis. × § =
Bennett, (Fort), Dak. ×	El Paso, Tex. ×	Miner's Camp, Idaho. ○
Benton, (Fort), Mont. ×	Eric, Pa. × =	Missoula, (Fort), Mont. ×
Bismarck, Dak. ×	Escanaba, Mich. × § =	Missoula Ferry, Mont. ○
Boise City, Idaho. ×	Father Point, Canada. ×	Mobile, Ala. × § =
Boston, Mass. × § = △	Florence, Ariz. ×	Moose Creek, Mont. ○
Bozeman, Mont. ○	Fredericksburg, Tex. ×	Montgomery, Ala. ×
Brackettville, Tex. ×	Froze-to-Death, Mont. ○	Montreal, Canada. ×
Brownsville, Tex. ×	Galveston, Tex. × § =	Moorhead, Minn. ×
Buffalo, N. Y. × § =	Garry, (Fort), Manitoba. ×	Morgantown, W. Va. × ¶
Buford, (Fort), Dak. ×	Gibson (Fort), Ind. Ter. ×	Mount Washington, N. H. ×
Burlington, Vt. × § △	Glendive, Mont. ○	Narragansett Pier, R. I. ○ ○
Burlington, Iowa. ○	Gould City, Tex. ○	Nashville, Tenn. × ¶ △
Cairo, Ill. × ¶	Graham, Tex. † ○	Navassa Island, W. I. ×
Campo, Cal. ×	Grand Haven, Mich. × § =	New Chicago, Mont. † ○
Cantonment, Ind. Ter. ○	Grant, (Fort), Ariz. ×	New Haven, Conn. × § =
Cape Henry, Va. × =	Grierson's Springs, Tex. † ○	New London, Conn. × § =
Cape Lookout, N. C. ○ ○	Griffin, (Fort), Tex. ×	New Orleans, La. × ¶ =
Cape May, N. J. × =	Grinnell's Ranch, Dak. ○	Newport, R. I. × § =
Castroville, Tex. ×	Halifax, N. S. ×	New River Inlet, N. C. ×
Catholic Mission, Idaho. ○	Harrisburg, Alaska. †	New Shoreham, Block Island,
Cedar Keys, Fla. × § =	Hatteras, N. C. × =	R. I. × § =
Champaign, Ill. ×	Havana, Cuba, W. I. ×	New Westminster, British Co-
Charleston, S. C. × § =	Helena, Mont. ×	lumbia. †
Charlotte, N. C. ×	Henrietta, Tex. ×	New York City. × § = △
Charlottetown, Prince Edward	Hoochuhoo, Alaska. †	Norfolk, Va. × § =
Island. ×	Huron, Dak. ×	North Platte, Nebr. ×
Chatham, N. B. ×	Indianapolis, Ind. ×	Nulato, Alaska. †
Chattanooga, Tenn. × ¶	Indianola, Tex. × § =	Ocean City, Md. ○ ○
Cheyenne, Wyo. ×	Jacksboro, Tex. ×	Olympia, Wash. ×
Chicago, Ill. × § = △	Jacksonville, Fla. × § =	Omaha, Nebr. × ¶
Chilcott, Alaska. †	Keogh, (Fort), Mont. ×	Oswego, N. Y. × =
Chincoteague, Va. × § =	Keokuk, Iowa. × ¶	Parry Sound, Canada. ×
Cincinnati, Ohio. × ¶ △	Kenai, Alaska. †	Pensacola, Fla. × § =
Cleveland, Ohio. × § =	Key West, Fla. × § =	Philadelphia, Pa. × △
Coal Banks, Mont. ○	Kingston, Canada, ×	Phoenix, Ariz. ×
Cœur d'Alene, (Fort), Idaho. ○	Kingston, Jamaica. †	Pike's Peak, Colo. ×
Coleman City, Tex. ×	Kaskakoin, Alaska. †	Piöche, Nev. ×
Colfax, Wash. † ○	Kittyhawk, N. C. × =	Pittsburgh, Pa. × ¶ △
Columbus, Ohio. ×	Knoxville, Tenn. ×	Plum Creek, Dak. ○
Colorado Springs, Colo. ⊕	La Crosse, Wis. × ¶	Point Judith, R. I. = ○
Concho, Tex. ×	La Mesilla, N. Mex. ×	Pomeroy, Wash. † ○
Cordova. †	Lapwai, (Fort), Idaho. † ○	Port Dover, Canada. ×
Corrilla station, Ariz. (near Camp	Laredo, Tex. ×	Port Eads, La. × § =
Lowell), ○	Leavenworth, Kans. + ¶ △	Port Etches, Alaska. †
Corsicana, Tex. ×	Lewiston, Idaho. ×	Port Huron, Mich. × =
Coulson, Mont. ○	Life-Saving Station No. 6, N.	Port Stanley, Canada. ×
Custer, (Fort), Mont. ×	C. ○ ○	Portland, Me. × § =
Davenport, Iowa, × ¶	Little Egg Harbor, N. J. ○ ○	Portland, Oreg. × ¶
Davis, (Fort), Tex. ×	Little Missouri, Mont. ○	Portsmouth, N. C. ×
Dayton, Wash. ×	Little Rock, Ark. × ¶	Powder River, Mont. ○
Deadwood, Dak. ×	Live Oak Rancho, Tex. ○	Prescott, Ariz. ×

Station.	Station.	Station.
Punta Rassa, Fla. × §	Stevenson, (Fort), Dak. ×	Yankton, Dak. × ¶
Quebec, Canada. ×	Stockton, Tex. ×	Yarmouth, N. S. ×
Quitman, (Fort), Texas. ○	Stillwater, (Mont), Dak. ○	Yates, (Fort), Dak. ×
Radersburg, Mont. ○	Saint Andrews, N. B. ×	York Factory, B. A. ×
Rapid City, Dak. : ○	Saint John's, Newfoundland. ×	Yukatak Bay, Alaska. †
Red Bluff, Cal. × ¶	Saint Louis, Mo. × ¶ △	Yukon, (Fort), Alaska. †
Reno, (Fort), Ind. Ter. : ○	Saint Michael's (Fort), Alaska. †	Yuma, Ariz. ×
Ringgold Barracks, Tex. ○	Saint Paul, Min. × ¶	
Rio Grande City, Tex. ×	Saint Paul's Island, Alaska. †	
Rochester, N. Y. × =	Saint Thomas, W. I. ×	
Rockliffe, Canada. ×	Saint Vincent, Minn. ×	
Rock Creek, Mont. : ○	Sitka, Alaska. †	
Rosebud, Mont. ○	Sully, (Fort), Dak. ○	
Roseburg, Oreg. ×	Supply, Ind. Ter. : ○	
Sacramento, Cal. ×	Superior City, Mont. ○	
Salt Lake City, Utah. ×	Sydney, C. B. ×	
San Antonio, Tex. ×	Terry's Landing, Mont. : ○	
San Carlos Agency, Ariz. ○	Thatcher's Island, Mass. × =	
San Diego, Cal. ×	Thomas (Camp), Ariz. ×	
San Elizario, Tex. ○	Toledo, Ohio. × § =	
Sandusky, Ohio. × § =	Toronto, Canada. ×	
Sandy Hook, N. J. × =	Tres Alamos, Ariz. ○	
San Francisco, Cal. × § △	Tucson, Ariz. ×	
Santa Fé, N. Mex. ×	Umatilla, Oreg. × ¶	
Santiago de Cuba, Cuba. ×	Unalashka, Alaska. †	
Saugeen, Canada. ×	Uvalde, Tex. ×	
Savannah, Ga. × § =	Verde, (Fort), Ariz. ×	
Sea Side Park, N. J. ○ ○	Vicksburg, Miss. × ¶	
Shaw, (Fort), Mont. ×	Victoria, Vancouver's Island, B. C. :	
Shreveport, La. × ¶	Visalia, Cal. ×	
Sill, (Fort), Ind. Ter. ×	Washington, D. C. × △	
Silver City, N. Mex. ×	Wickenburg, Ariz. ×	
Sloop Point, N. C. ○ ○	Willcox, Ariz. ○	
Smithville, N. C. × § =	Wilmington, N. C. × § =	
Smithville, Dak. ○	Winnemucca, Nev. ×	
Spangle, Wash. ○	Wichita Agency, Ind. Ter. ○	
Spokane Falls, Wash. ×	Wood's Holl, Mass. × § =	
Springfield, Ill. ×		
Springfield, Mass. ×		

Special River stations.

Albany, Oreg. ¶
 Boonville, Mo. ¶
 Brownsville, Pa. ¶
 Brunswick, Mo. ¶
 Colusa, Cal. ¶
 Confluence, Pa. ¶
 Decatur, Ala. ¶
 Eugene City, Oreg. ¶
 Evansville, Ind. ¶
 Folsom, Cal. ¶
 Fort Smith, Ark. ¶
 Freeport, Pa. ¶
 Helena, Ark. ¶
 Hermann, Mo. ¶
 Jefferson City, Mo. ¶
 Kansas City, Mo. ¶
 Le Claire, Iowa, ¶
 Lexington, Mo. ¶
 Marietta, Ohio. ¶
 Marysville, Cal. ¶
 Muscatine, Iowa. ¶
 New Geneva, Pa. ¶
 Oil City, Pa. ¶
 Oroville, Cal. ¶
 Paducah, Ky. ¶
 Plattsmouth, Nebr. ¶
 Saint Joseph, Mo. ¶
 Warsaw, Ill. ¶

× First-class stations.

¶ River measurement stations.

△ Printing stations.

† Second-class stations.

§ Water temperature stations.

○ Sunset stations.

⊕ Supply stations.

: Third-class stations.

= Cautionary signal stations.

○ Repair stations.

First-class stations are those which take, or should take, the three simultaneous Signal Service observations at 7 a. m., 3 p. m., and 11 p. m., Washington mean time. Second-class stations are those which take two observations daily at 3 p. m. and 11 p. m., Washington mean time. Third-class stations are those which take one observation daily, at sunset. All stations of the first, second and third classes, in the United States, take a sunset observation.

15. After delivering his own reports, each observer, or an assistant designated by the observer, will remain in the telegraph office until they are sent to their proper destination, and until the reports from other stations intended for use at his station are received, or until assured that their receipt has been prevented by some cause beyond the control of the operator. The reports for

should be received by a. m., p. m., and m., respectively; and when they are delayed beyond these hours, the facts should in all cases be promptly reported to this Office by mail, with a statement of the cause of delay, when known.

16. To avoid useless delay in getting out the bulletins, observers will arrange, when practicable, to have the use of a desk or table in or near the operating room of the telegraph office, in order that the reports may be translated and written out as rapidly as received. Where permission to occupy the room for this purpose is granted by the manager, a small table will be furnished by this Office for the use of the observer, whenever necessary.

17. The telegraph offices at which the reports are received will be kept supplied by the observers with Form 204, and such other forms as may

be authorized. These forms must not be furnished to telegraph offices for the purpose of making copies of the reports for their own use. In all cases the receiving operator will be required to fill up Form 204 with the name of station, *date*, and time at which reports are received. Observers will in like manner fill up Form 203 before delivery.

18. *Reports must be made on Sundays at the regular hours, and punctually delivered at the telegraph office.*

19. Immediately upon the receipt of the morning reports at any station, the observer will translate them into ordinary language, and write them out clearly and plainly on the manifold bulletin (Form 107) filling in each column with the data named in its heading. Copies of the bulletin will be regularly posted in the rooms of the board of trade, chamber of commerce, and such other conspicuous places as may have been officially designated. No change in the number of bulletins displayed or places at which posted will be made without authority, except in cases of removal or closing of places of business. In such cases a bulletin frame may be removed and the issue discontinued, but the fact must be immediately reported to this Office. If private individuals at any station desire to be furnished with copies of the bulletin, they will be requested to make written application for them to the Chief Signal Officer, stating the uses to which they are to be applied. This application will be forwarded by the observer, with such indorsement as his knowledge of the case will warrant. A copy of the bulletin will be furnished to each newspaper published at the station, provided its regular publication can be secured. The local observations will invariably be entered in all bulletins, press reports, and maps.

20. At stations supplied with manifold maps, their preparation follows the bulletin, when bulletins are also issued, and they will be printed as rapidly as practicable, and furnished to such parties as may be designated by this Office, upon the recommendation of the observer in charge.

21. The "War Department Weather Map" will be changed in accordance with the following key and instructions:

The index consists of an arrow, disk, and card, which show the direction and velocity of the wind, state of the weather, height of the barometer, height of the thermometer, dew point, and sunset prediction of the previous day at the place at which they are affixed. The index will be changed once daily, at 10 a. m., or as near that hour as is practicable. The arrow flies with the wind.

A red disk indicates clear weather.

A $\frac{1}{4}$ -blue disk indicates sky $\frac{1}{4}$ covered with clouds.

A $\frac{1}{2}$ -blue disk indicates sky $\frac{1}{2}$ covered with clouds.

A $\frac{3}{4}$ -blue disk indicates sky $\frac{3}{4}$ covered with clouds.

A blue disk indicates sky covered with clouds.

A black disk indicates rain.

A white and black barred disk indicates snow, hail, or sleet.

A white (reverse side) disk indicates foggy weather.

A square symbol, red with black center, indicates the display of the cautionary signal.

22. A square symbol divided into equal horizontal sections, the upper section white and the lower red, the section having a common square center of black, indicates the display of the off-shore or northwest signal.

23. Upon a silicate tag projecting below the disk, and held in position by the same screw or spring that fastens the arrow and disk, is written the velocity of the wind in miles per hour, the height of the barometer in inches and hundredths, the height of the thermometer in degrees Fahrenheit, and the dew point.

24. The character of the sunset of the preceding day will be indicated on the map by a cross made at the bottom of the tag. A *red* cross shows that the sunset indicated fair weather for the succeeding day; a *blue* cross foul weather; and a *red* and *blue* cross that the observer was in doubt as to the character of the weather indicated by the appearance of the sky.

25. In changing the symbols, a clean set of tags will be substituted for the ones on which the previous reports were written, and these latter subsequently cleaned for future use by means of a small piece of sponge, slightly moistened.

With proper care, these tags will thus last for a number of months.

26. The barred disk A (Fig. 2) indicates snow, and the position of the arrow, *a*, that the wind is blowing from the east. The upper figure on the card, *c*, shows that the velocity with which the wind is blowing is seven miles per hour. The height of the barometer (reduced to sea level) shown by the middle figures, is twenty-nine inches and fifty-five hundredths; the height of the thermometer, twenty-eight degrees above zero; the dew point indicated by the lower figures, is twenty-six degrees; and the cross, the sunset prediction, the character of which will be shown by its color or colors. When the temperature is below zero, the minus sign must always be prefixed.

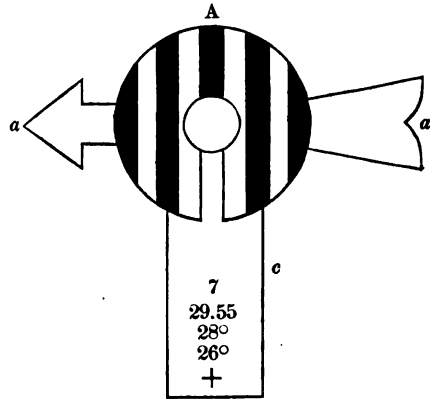


Fig. 2.

27. A calm is indicated by the omission of the arrow, as shown in Fig. 3.

Care must be taken to change the calendar regularly, so as to show the proper date of report, and also to remove the symbols at the stations from which current reports have not been received at the time the map is changed. When new stations are added to the number on the map, proper arrangements for the display of their reports will be made by the observer.



Fig. 3.

28. The afternoon reports will be received and translated in the same manner as those received in the morning, and will be bulletined at such places as may be authorized by this Office. At stations where the morning papers go to press too early for the publication of the midnight report, they will be furnished with the afternoon issue, when such is authorized by proper authority from this Office.

29. The night reports will be received and translated in the same manner as those received in the morning, and will be carefully and promptly written out on Form 107, and furnished to such morning papers printed at the station as are authorized to receive them for publication, provided they can be reached before the hour of going to press. Observers will endeavor to arrange with the publishers to have these reports taken from the signal office; but where this arrangement cannot be effected, the observer, or his assistant, will deliver them in person.

30. At stations where the publishers of newspapers desire to have the three reports of the previous day, they will be supplied by the observers. In such cases, observers will write up the morning and afternoon reports during the day and evening, so that there will be no delay in getting

out the full report at midnight. In carrying out that part of their duty which relates to the publication and distribution of reports, observers must act promptly and intelligently, as the usefulness of the reports depends wholly upon the speed and accuracy with which they are laid before the public.

31. *In furnishing weather reports and items for publication, observers must confine themselves strictly to the instructions issued from this Office, and will not, under any circumstances, publish, or cause to be published, forecasts or predictions of the weather, except such as are issued from this Office.* Observers must not furnish information or data regularly to any person or persons without first obtaining authority from this Office to do so, *nor will they furnish information in advance of the issue of the manifold bulletin.* Requests for meteorological data to be furnished from this Office must come from the parties desiring the same. The observer in forwarding requests of this kind must add such indorsement as the facts in the case warrant.

32. A copy of the latest Indications and Special Bulletin received by the observer or obtained from the Associated Press at stations where they are regularly received will be posted with each copy of the Bulletin or map that is publicly displayed.

33. Observers will be held directly responsible for the correct publication of all weather reports at their respective stations, and must take every precaution to guard against errors, especially in the newspaper copies, where, owing to the hasty composition, they are most frequently found. The accuracy of the published reports must be verified by daily personal inspection, and when errors are found they should be traced to their proper sources, and measures taken to prevent their repetition as far as lies in the power of the observer. *The use of the regular official heading authorized by this Office for all reports must be insisted upon, and care taken that the correct time of issue is given to the Bulletins, Special Bulletins, and Indications.*

34. When the wires of the telegraph company by which the reports are regularly transmitted are known to be down or obstructed in such a manner as to prevent the prompt transmission of reports, these reports must be sent, until such obstruction is removed, *over the wires of any other company possessing the necessary facilities.*

35. At all stations ordered to make river reports, the depth of water will be observed daily at _____ M., local time, corresponding with 2 p. m. Washington time, and embodied in the next telegraphic report.

36. Whenever any sudden or unusual change occurs in the condition of the river, a special series of observations will be made, which will be reported in the usual manner at the next telegraphic report. These special reports will be continued tri-daily (one at each telegraphic report) until the river resumes its normal condition, when they will be discontinued.

37. Observers will use the cipher words in the column headed "Rise" when the river is rising at the date of report, and those in the column headed "Fall" when it is falling. When the river is at a stand, the cipher word will be taken from the column used in making the preceding report.

38. The observations for the morning and midnight special river reports will be made, if practicable, within an hour of the time of report.

Observers must exercise the utmost care in making and recording the river observations, in order that they may be relied upon as accurate by interested parties.

39. The amount of precipitation (rain and melted snow) will be measured and reported at each of the three telegraphic reports only. Should more than four (4) inches of rain-fall be recorded, two (2) cipher words will be used in reporting it.

40. The observer at each station will note, each day, at the exact time of sunset, and for a time not to exceed thirty minutes after sunset, the character of the western sky and of the sunset, and will state this character at the time, in writing, as "Fair Weather Sunset," "Doubtful Sunset," "Foul Weather Sunset." The term "Fair Weather Sunset" will express such condition of the sky, particularly the western, and such character of the sunset as is considered to indicate a clear day for the day ensuing. The term "Doubtful Sunset" will indicate that the conditions are such as to leave the observer in doubt as to what the sunset presages for the following day. The term "Foul Weather Sunset" will be used when the appearance of the western sky at sunset indicates rain or snow before the next sunset. It will be frequently noticed at the time of sunset that the western sky, while exhibiting generally the characteristics of a fair-weather sunset, is tinged more or less and in different places with the colors yellow or green. It is important that these colors should be carefully noted. In some instances the sunset will be found a decidedly yellow sunset, that being the predominant color of the western sky. The color green is rarely the predominant color, but portions of the western sky will sometimes markedly exhibit it. For purposes of observation and report the sunsets so differently described are known as yellow sunsets or green sunsets. Care must be taken in reference to reporting yellow, and particularly in reporting green, sunsets. The observer is to be quite sure that he clearly sees "green," and enough of it to be worthy of report. Whenever green is reported, the retained copy of Form 203 will have written upon it the extent of western sky-surface seen apparently so colored, as $\frac{1}{2}$, $\frac{1}{4}$, and so on. Yellow sunsets and green sunsets will be considered as "Fair Weather Sunsets."

The observer will endeavor to note either "Fair Weather" or "Foul Weather," noting as few "Doubtful" as possible. It is considered that practice will be found to make this comparatively easy. The note made for each evening will, at sunset of *next* day, be noted in writing as "verified" or "not verified." These observations will be recorded daily in the Original Record.

The sunset prediction will be the last entry in the Journal and Abstract for the day, and its verification, as determined by the weather from the hour of prediction up to sunset of the ensuing day, be entered on the same line with it. In making sunset predictions only local observations will be used.

An additional word will be added to the "midnight" report from the station when the character of the sunset is "Doubtful" or indicates "Foul Weather." If, however, after the cipher word for thermometer, and before that for the dew point, no word is added, it will be understood at this Office that the station reports a "Fair Weather Sunset." If the station reports a "Doubtful Sunset," it will do so by adding after the cipher word for thermometer, and before that for the dew point, the word "Doubt." If the report is "Foul Weather Sunset," it will add, in the same space, the word "Foul." If a yellow sunset, the word "Yellow" will be added in the same space. If a green sunset, the word "Vert" will be added in the same space.

A sunset prediction of one day is verified, or not verified, as the case may be, by the weather until sunset of the ensuing day.

LOCAL TIME

The following table is furnished to observers of the Signal Service to enable them to know the the column for any particular latitude will be used by the

Date.	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°
	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>
January 1	5 22	5 20	5 18	5 16	5 14	5 12	5 09	5 07	5 05	5 02
January 11	5 30	5 28	5 26	5 24	5 22	5 20	5 18	5 16	5 14	5 11
January 21	5 37	5 35	5 34	5 32	5 30	5 28	5 26	5 24	5 22	5 20
February 1	5 45	5 43	5 42	5 40	5 39	5 38	5 36	5 34	5 32	5 30
February 11	5 52	5 51	5 50	5 48	5 47	5 46	5 45	5 43	5 42	5 40
February 21	5 58	5 57	5 56	5 55	5 54	5 54	5 53	5 52	5 51	5 49
March 1	6 03	6 02	6 02	6 02	6 01	6 00	6 00	5 59	5 58	5 57
March 11	6 08	6 07	6 07	6 07	6 06	6 06	6 05	6 05	6 04	6 04
March 21	6 12	6 12	6 12	6 12	6 12	6 12	6 12	6 12	6 13	6 13
April 1	6 17	6 18	6 18	6 18	6 19	6 19	6 20	6 21	6 21	6 22
April 11	6 21	6 21	6 22	6 23	6 24	6 25	6 25	6 26	6 27	6 28
April 21	6 26	6 27	6 28	6 29	6 30	6 31	6 33	6 34	6 35	6 37
May 1	6 31	6 32	6 33	6 35	6 36	6 38	6 39	6 41	6 43	6 44
May 11	6 35	6 36	6 38	6 40	6 42	6 44	6 46	6 48	6 50	6 52
May 21	6 40	6 42	6 44	6 46	6 48	6 50	6 52	6 55	6 57	6 59
June 1	6 45	6 47	6 49	6 51	6 54	6 56	6 58	7 01	7 03	7 06
June 11	6 49	6 51	6 53	6 55	6 58	7 00	7 02	7 05	7 08	7 11
June 21	6 52	6 54	6 57	6 59	7 01	7 03	7 05	7 08	7 11	7 14
July 1	6 53	6 55	6 57	6 59	7 02	7 04	7 06	7 09	7 12	7 15
July 11	6 53	6 55	6 57	6 59	7 02	7 04	7 07	7 09	7 12	7 14
July 21	6 50	6 52	6 54	6 56	6 58	7 00	7 03	7 05	7 08	7 10
August 1	6 45	6 46	6 48	6 50	6 51	6 53	6 55	6 57	6 59	7 01
August 11	6 38	6 39	6 41	6 42	6 43	6 45	6 47	6 48	6 50	6 52
August 21	6 30	6 31	6 32	6 33	6 34	6 36	6 37	6 39	6 40	6 41
September 1	6 20	6 20	6 21	6 22	6 23	6 24	6 24	6 25	6 26	6 27
September 11	6 09	6 10	6 10	6 10	6 11	6 12	6 12	6 13	6 13	6 14
September 21	5 58	5 58	5 58	5 58	5 59	5 59	5 59	5 59	5 59	5 59
October 1	5 48	5 47	5 47	5 47	5 46	5 46	5 46	5 46	5 45	5 45
October 11	5 37	5 37	5 36	5 35	5 35	5 34	5 34	5 33	5 32	5 32
October 21	5 28	5 28	5 27	5 26	5 25	5 24	5 22	5 21	5 20	5 19
November 1	5 20	5 19	5 18	5 16	5 15	5 14	5 12	5 11	5 09	5 08
November 11	5 14	5 12	5 11	5 09	5 08	5 06	5 04	5 03	5 00	4 58
November 21	5 12	5 10	5 08	5 06	5 04	5 02	5 00	4 58	4 56	4 54
December 1	5 10	5 08	5 06	5 04	5 02	5 00	4 58	4 55	4 53	4 50
December 11	5 12	5 10	5 08	5 06	5 04	5 02	5 00	4 57	4 54	4 51
December 21	5 16	5 14	5 12	5 10	5 07	5 05	5 03	5 00	4 58	4 55
Stations having corresponding latitudes—	Key West	Brownsville; Edinburgh; Rio Grande City	Punta Raesa	Eagle Pass; Laredo; Cedar Keys; Port Eads	Brackettville; Galveston; Castroville; Indianola; San Antonio; Uvalde	McKavett; New Orleans; Fredericksburg; Jacksonville; Pensacola	Mobile; Mason; Concho; Stockton; Davis; Quitman	Coriscana; Shreveport; Tucson; La Mealla; Montgomery; Savannah; Vicksburg; Goodwin; Tres Alamos; Apache Pass; Corrilla; El Paso; Coleman City	Augusta; Fort Bayard; Decatur; Griffin; Burkes; Charleston; Jacksboro; Florence; Silver City; Campo; Yuma; Pilot Point; Graham; Grant; Maricopa; San Diego	New River; Denison; Phoenix; Wilmington; Apache; Henrietta; Smithville; Craig; Atlanta; Los Angeles; Sloop Point; Wickenburg

OF SUNSET.

approximate time of sunset at any station and for any day of the year. The time of sunset given in stations named at the foot of the corresponding column.

35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	50°
<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>	<i>h. m.</i>
5 00	4 57	4 54	4 51	4 48	4 46	4 43	4 40	4 36	4 33	4 29	4 25	4 21	4 17	4 13	4 08
5 09	5 06	5 04	5 01	4 59	4 56	4 53	4 50	4 47	4 44	4 41	4 37	4 34	4 30	4 26	4 22
5 19	5 16	5 14	5 11	5 08	5 06	5 03	5 01	4 58	4 56	4 53	4 50	4 47	4 43	4 40	4 36
5 29	5 27	5 25	5 23	5 21	5 19	5 16	5 14	5 12	5 10	5 08	5 05	5 03	5 00	4 58	4 55
5 39	5 39	5 37	5 35	5 33	5 32	5 31	5 29	5 27	5 25	5 23	5 21	5 18	5 15	5 14	5 12
5 48	5 47	5 46	5 45	5 44	5 43	5 41	5 40	5 39	5 37	5 36	5 35	5 34	5 33	5 31	5 30
5 56	5 56	5 55	5 55	5 54	5 53	5 52	5 51	5 50	5 49	5 48	5 47	5 46	5 45	5 44	5 43
6 04	6 04	6 03	6 03	6 03	6 03	6 02	6 02	6 02	6 01	6 01	6 01	6 00	6 00	5 59	5 59
6 13	6 13	6 13	6 13	6 13	6 13	6 13	6 13	6 14	6 14	6 14	6 14	6 14	6 15	6 15	6 15
6 22	6 22	6 23	6 23	6 24	6 24	6 25	6 26	6 26	6 27	6 28	6 29	6 29	6 30	6 31	6 32
6 29	6 30	6 31	6 32	6 33	6 34	6 35	6 36	6 37	6 38	6 40	6 42	6 43	6 45	6 46	6 47
6 38	6 40	6 41	6 43	6 44	6 45	6 47	6 48	6 50	6 52	6 54	6 56	6 58	7 00	7 02	7 04
6 46	6 47	6 49	6 51	6 53	6 55	6 57	6 59	7 01	7 03	7 06	7 08	7 11	7 14	7 16	7 18
6 53	6 55	6 56	6 59	7 01	7 04	7 06	7 09	7 12	7 14	7 17	7 20	7 23	7 27	7 30	7 34
7 01	7 04	7 06	7 09	7 11	7 14	7 16	7 19	7 22	7 25	7 28	7 32	7 36	7 40	7 43	7 47
7 08	7 10	7 13	7 16	7 19	7 22	7 25	7 29	7 32	7 35	7 39	7 43	7 47	7 51	7 55	7 59
7 14	7 16	7 19	7 22	7 25	7 28	7 31	7 35	7 38	7 42	7 46	7 50	7 55	7 59	8 03	8 08
7 17	7 20	7 23	7 26	7 29	7 32	7 35	7 39	7 43	7 46	7 50	7 55	7 59	8 04	8 08	8 13
7 18	7 20	7 23	7 26	7 29	7 32	7 36	7 39	7 43	7 47	7 50	7 55	7 59	8 03	8 07	8 12
7 16	7 18	7 21	7 24	7 27	7 30	7 33	7 37	7 40	7 43	7 47	7 51	7 55	7 59	8 03	8 07
7 12	7 14	7 17	7 19	7 21	7 24	7 27	7 30	7 33	7 36	7 39	7 42	7 46	7 50	7 54	7 58
7 03	7 05	7 07	7 09	7 12	7 14	7 17	7 19	7 22	7 24	7 27	7 30	7 33	7 36	7 39	7 43
6 54	6 55	6 57	6 58	7 00	7 02	7 04	7 07	7 09	7 12	7 14	7 16	7 19	7 21	7 24	7 26
6 42	6 43	6 44	6 46	6 47	6 49	6 50	6 52	6 54	6 55	6 57	6 59	7 01	7 03	7 05	7 07
6 28	6 29	6 30	6 31	6 32	6 33	6 34	6 35	6 36	6 37	6 38	6 39	6 41	6 42	6 44	6 45
6 14	6 14	6 15	6 15	6 16	6 16	6 17	6 17	6 18	6 19	6 20	6 20	6 21	6 22	6 22	6 23
5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59	6 00	6 00	6 00	6 00	6 00	6 01	6 01	6 01
5 45	5 44	5 44	5 44	5 43	5 43	5 43	5 42	5 42	5 41	5 41	5 41	5 40	5 40	5 39	5 39
5 31	5 30	5 29	5 29	5 28	5 27	5 27	5 26	5 25	5 24	5 23	5 23	5 21	5 20	5 19	5 18
5 18	5 17	5 16	5 15	5 14	5 12	5 11	5 09	5 08	5 07	5 06	5 04	5 02	5 01	4 59	4 58
5 06	5 04	5 03	5 01	5 00	4 59	4 57	4 55	4 53	4 51	4 49	4 47	4 45	4 43	4 40	4 38
4 57	4 55	4 53	4 51	4 49	4 47	4 45	4 43	4 40	4 38	4 36	4 33	4 30	4 27	4 24	4 21
4 52	4 50	4 47	4 45	4 42	4 40	4 37	4 34	4 32	4 29	4 26	4 23	4 19	4 16	4 12	4 09
4 48	4 46	4 43	4 41	4 38	4 36	4 33	4 30	4 27	4 24	4 20	4 16	4 13	4 09	4 06	4 02
4 49	4 46	4 43	4 41	4 38	4 36	4 33	4 30	4 27	4 23	4 19	4 15	4 11	4 07	4 03	3 59
4 53	4 50	4 47	4 44	4 42	4 39	4 36	4 32	4 29	4 26	4 22	4 18	4 14	4 10	4 06	4 01
Hatteras; Sill; Chattanooga; Cape Lookout; Memphis; Verde; Prescott; Portsmouth; Charlotte; Macon; Little Rock; Wichita.	Gibson; Kittyhawk; Knoxville; Nashville; Santa Fé; Visalia; Life Saving Station, No. 6, N. C.; Fort Elliott; Fort Reno.	Cairo; Cape Henry; Lynchburg; Norfolk; Supply.	Dodge City; Louisville; San Francisco; Pioche; Chincoteague.	Atlantic City; Cincinnati; Saint Louis; Baltimore; Leavenworth; Cape May; Pike's Peak; Colorado Springs; Washington; Sacramento; Del. Breakwater.	Barneget; Keokuk; Morgantown; Austin, Nev.; Denver; Indianapolis; Sandy Hook; Philadelphia; Red Bluff; Columbus; Springfield, Ills.; Champaign.	Cheyenne; New York; Pittsburgh; Cleveland; North Platte; Detroit; Newport; New London; New Haven; Omaha; Salt Lake City; New Shoreham; Burlington, Iowa; Winnemucca; Logansport; Sandusky.	Boston; Davenport; Erie; Chicago; Detroit; Toledo; Springfield, Mass.; Wood's Holl; Des Moines.	Albany; Dubuque; Oswego; Buffalo; Grand Haven; Port Huron; Milwaukee; Thatchers Island; Rochester; Yankton; Madison; Roseburg.	Burlington, Vt.; Mount Washington; La Crosse; Portland, Me.; Deadwood; Boise City; Rapid City; Smithville; Meade.	Alpens; Eastport; Saint Paul; Virginia City; Bangor; Bennett; Sully; Little Missouri; Plum Creek.	Breckenridge; Escanaba; Portland, Oreg.; Custer; Keogh; Umatilla; Yates; Lewiston; Deer Lodge; Powder River; Radersburg; Rosebud; Terry's Landing; Dayton; Lapwai; Pomeroy; Coulson.	Bismarck; Duluth; Marquette; Olympia; Missoula; Shaw; Helena; Glendive; New Chicago; Colfax; Almoda.	Buford; Victoria; Vancouver's Island; Fort Stevenson; Cœur d'Alene; Fort Benton; Coal Banks; Spokane Falls.	New Westminster; British Columbia; Assiniboine.	Lytton, British Columbia.

The prediction "FOUL" or "FAIR" refers especially to precipitation, and does not refer, in any way, to amount or kind of clouds or fog.

The prediction "FOUL" means that the appearance of the sky indicates precipitation. If *any* precipitation equaling or exceeding one one-hundredth of an inch falls before sunset on the ensuing day, the prediction is verified; and if not, it is *not* verified.

41. FAIR means that the appearance of the sky does not indicate precipitation, and if no precipitation occurs, or less than one one-hundredth of an inch, the prediction is verified; if *any* precipitation in excess of this amount falls, the prediction is *not verified*.

DOUBTFUL sunsets cannot be verified.

In using the table (see pages 14 and 15) for determining the proper times for taking the sunset observation, the times opposite the dates will be used as follows, viz: The time opposite the first of each month will be used on all dates from the first until the tenth; the time opposite the eleventh will be used on all dates from the eleventh until the twentieth; the time opposite the twenty-first will be used on all dates from the twenty-first until the last of the month.

INSTRUMENTS.

42. Each station of the first class will be supplied with the following instruments:

Two mercurial barometers.

Two exposed thermometers.

Two wet bulb thermometers.

Two maximum thermometers.

Two minimum thermometers.

Two anemometers and one self-registering attachment.

Two wind-vanes, (large and small.)

One rain-gauge.

One clock.

Other instruments may be added from time to time, as the necessity for their use becomes apparent.

BAROMETER.

43. The barometers used on signal-stations of observation will in all cases be carefully compared with the standard at this office before issue, and the corrections to be applied for instrumental error of barometer and attached thermometer sent with each when issued.

The barometers at each station must be carefully compared on the last two days of each month, by the observer in charge making a series of comparative readings of not less than ten in number, five being made each day at hourly intervals, the result of which will be recorded, as soon as made, in the daily journal. These comparative readings must not be corrected for elevation, but for temperature and instrumental error only.

In this connection it must be borne in mind that the *correction* for instrumental error is the reverse of the instrumental error; that is, if the error of a barometer is plus (+), the instrument reads too high and an amount equal to the error must be subtracted in order to correct for the error, and vice versa when the error is minus (—). Upon all forms the words "Correction for Instrumental Error" will be written instead of the words "Instrumental Error."

No change of correction for instrumental error will be made without direct authority from this Office.

44. The barometer must be suspended so that the top of the mercurial column will be about the height of the eye, near a window, in such a manner as to be lighted perfectly, without exposure either to the direct rays of the sun or to the currents of air which are always found at the window-casings and doors. To protect the instrument from external injuries, from dust, and from the direct radiation of warm bodies or currents of air from the window, observers must fasten the wooden case, in which it is carried, firmly against the wall in a vertical position. An opening large enough to admit the tube of the barometer must be cut in the upper end of the box, and directly above this, at the distance of one inch, a strong hook must be driven into the wall. This hook must be small enough to allow the barometer to swing freely upon it and to hang in a perfectly vertical position, and should extend two or three inches beyond the box, and upon it the instrument will be suspended. When not in use, the cover will be closed; but when an observation is to be taken, it will be opened, and the instrument drawn out on the hook, clear of the box, and in the full light of the window. After the observation is made the barometer must be slipped back and the box closed.

45. A reading of the barometer taken for telegraphic transmission must be corrected by the observer making the observation, for temperature, for *instrumental* error, and for *elevation*, before being sent from his station. In correcting for temperature, the reading of the *attached* thermometer will be used, while, in correcting for elevation, the proper constant will be taken from the table furnished by this office.

In correcting for temperature, Table VII will be used; and for elevation, the table of constants.

46. The elevation to be corrected for at
is feet, as follows:

Height of	above mean tide-level,
feet. Height of ground, which should be a mark upon a door sill,	
coping stone, or other permanent object, and noted in the station	
record at office above or below datum-point,	feet. Height
of mercury in cistern of barometer above ground,	feet. Total
height to be corrected for,	feet.

47. Observers will obtain from reliable sources the proper figures to fill up the blank spaces in the preceding paragraph, and will report them promptly to this Office on the form "Report of Instruments and their Positions," provided for this purpose.

In reporting the datum-point, or bench mark, observers must be particular to give its *exact* location and the authority therefor; they will also, in every instance, give the authority for all measurements above or below such datum-points, to the surface of the mercury in the cistern of the barometer, and be assured that the measurements made by themselves are accurate, and must state it in such a clear and concise manner as to leave no room for doubt in reference thereto. The data from which the elevation of the datum-point above mean sea-level has been determined will be kept on file at the station. They will also briefly and clearly state on the form any other information in relation to the position of the instruments not provided for by the printed headings.

48. In moving a barometer even across a room, it should be screwed up and carried with the cistern uppermost. For traveling, it is provided with a wooden case. On steamboats or railroads, it should be hung up in a stateroom or car, and the lower end firmly strapped to the

side of the room or car, to prevent jarring. In wheeled vehicles, it should be carried by hand, supported by a strap over the shoulder, or held upright between the legs; but it must *not* be allowed to rest on the floor of the carriage, as a sudden jolt might break the tube. If carried on horseback, it should be strapped over the shoulders of the rider, where it is not likely to be injured, unless the animal is subject to a sudden change of gait. When required for use, it must be taken from its case, gently inverted, hung up and unscrewed. While it has the cistern uppermost the tube is full—is one solid mass of metal and glass—and not easily injured; but when hung up a sudden jolt might send a bubble of air into the vacuum at the upper end of the tube, and the instrument become useless until repaired. Observers must never *swing* the barometer or endeavor to force the mercury against the top of the tube without first screwing up the large adjusting-screw at the base of the cistern.

49. If the cistern should become dirty, it can be cleaned with safety and without changing the zero of the instrument. Everything used in the operation must be clean and dry. Blowing upon any of the parts must be avoided, as the moisture from the breath is injurious.

The instrument being placed vertically, the cistern uppermost, unscrew and take off the brass casing which incloses the wooden and leathern part of the cistern. This wooden part (which has the grain crosswise and therefore is not air-tight) is made in two pieces, fastened together by four screws and four brass pieces. It will be necessary to take out two of these screws and loosen the other two, when the brass pieces can be taken off. The upper wooden piece, to which the bag is attached, can then be lifted off, and the mercury will be exposed. By then inclining the instrument a little, a portion of the mercury in the cistern may be poured out into a clean vessel at hand to receive it, when the end of the tube will be uncovered. This is to be closed by the *gloved hand*; when the instrument can be inverted, the cistern emptied, and the tube brought again to its vertical position. Care must be taken to prevent any mercury from passing out of the tube. The long screws which fasten the glass portion of the cistern to the other parts can then be taken off, the various parts wiped with a clean cloth or handkerchief, and restored to their former positions. The mercury which has been taken out of the cistern must now be cleaned, or replaced by other that is clean and pure. If the old mercury is merely dusty, or dimmed by a film of oxide, the cleaning may be effected by straining it through chamois leather, or through a funnel with a capillary hole at the end, of a size to admit of the passage of but a small thread of the metal. Such a funnel is conveniently made of letter-paper. The dust will adhere to the skin or paper and the filtered mercury will present a clean and bright appearance. At stations where muriatic acid can be procured, the mercury may be easily and quickly cleaned by mixing with it about two ounces of the acid in a small vessel or cup, and then pouring into the vessel clear water until it overflows and carries off all the impurities. When sufficiently pure, the water must be poured off, and the mercury heated over a gas or lamp light until all remaining moisture is expelled. If chemically impure, it should be rejected, and fresh, clean mercury used. With such clean mercury, the cistern must be filled as nearly full as possible, the wooden portions put together and securely fastened by the screws and clamps, the casing screwed on, and the screw at its end screwed up. The instrument can then be hung up and readjusted. If a little mercury has been lost during the operation, and there is none at hand to replace it, no serious harm has been done; but if much is lost

fresh mercury must be added to prevent the open end of the tube from becoming exposed while inverting the instrument.

Should any air have entered the tube during the process of cleaning, efforts will be made to expel it by screwing the mercury into the tube, then inverting the instrument, loosening the screw and tapping the top against the shoe. If this fails to expel the air the fact that the barometer is unserviceable will be promptly reported to this Office.

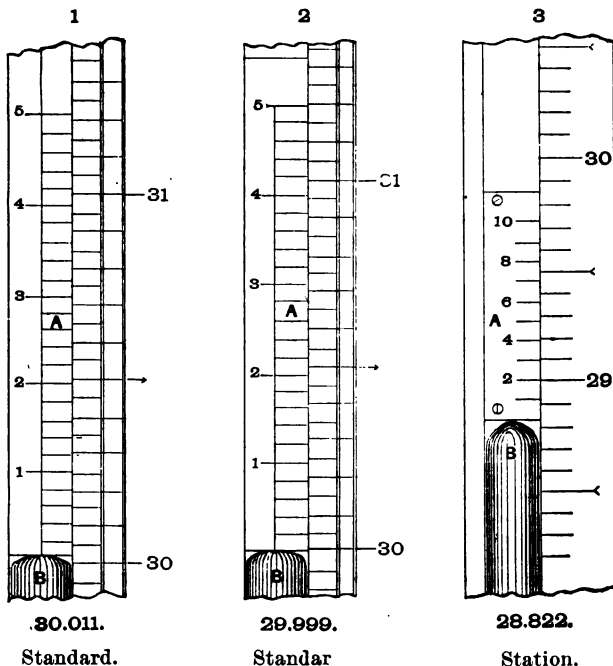
50. Station-barometers will not be cleaned or repaired unless ordered from this Office, or by an inspecting officer, or when such action appears to be immediately and absolutely necessary. In any case the fact will be promptly reported to this Office, stating the number of the instrument cleaned or repaired, with date and result of the operation, and the record of a full series of comparative readings taken immediately before and after cleaning will be forwarded.

51. A piece of white paper will be placed in the barometer-box behind the tube to reflect the light and aid in setting the vernier accurately.

To take a reading of the barometer—

1st. Read the attached thermometer to the nearest half degree.

2d. Adjust the surface of the mercury in the cistern carefully to the ivory point or zero of the scale. When the mercury is perfectly pure the proper adjustment can be easily made by causing the actual point of the zero-pin to coincide exactly with its reflected image in the mercury below; but when the mercury is covered with a slight film of oxide it is necessary to determine the contact by immersing the point in the mercury first, and then slowly lowering the screw until the depression caused by this immersion disappears.



3d. Tap the barrel of the barometer firmly, to free the mercury from the sides of the tube and readjust the zero of scale.

4th. Bring the lower edges of the vernier to the column of mercury, so that they exactly coincide with the top of the meniscus or curvature of the column, without cutting off any of the light at the angles, as shown in the above plates, where A represents the vernier, and B the column of mercury. At night the light from the lamp must be thrown upon the paper. The barometer must never be turned towards a distant white wall, a window, or an artificial light, but always towards the white paper in adjusting the vernier.

5th. The inches and tenths will then be read from the scale, and the hundredths and thousandths from the vernier.

All extra barometers, when not in use, must be kept screwed up sufficiently to keep the cisterns filled, to prevent oxidation of the mercury.

EXPOSED THERMOMETER.

52. The thermometer must be hung in the instrument-shelter in such a position that it will always be in the shade, and at least one foot from the wall of the building to which the shelter is attached. It must be protected against the heat reflected from surrounding objects, and from rain, snow, and hail. The instrument must be hung vertically, with the middle of the scale at a height that will bring it on a level with the eye of the observer. The readings must be made at all times, but especially in winter, *through the panes* of glass, without raising the sash, when the shelter is built out from a window. When the shelter is built upon the roof, great care must be exercised in making the readings, in order to prevent the instrument from being affected by the heat of the body or the lantern at night. The observation must be made as rapidly as is consistent with accuracy.*

53. The accuracy of all thermometers at each station will be tested on March 31, June 30, September 30, and December 31, of each year, in the following manner:

Place the thermometers to be tested in the vessel provided for this purpose, keep them in a vertical position, pack finely-pounded ice around them to a height a little above the freezing point, and let them remain for one-half hour, at the expiration of which time read off the height of the mercury, without removing the thermometers from the ice, and note the result of the test of each thermometer in the Daily Journal, and report it to this Office in the Journal Abstract. If corrections have been authorized for any thermometer, the fact, with amount of such correction, will be stated. In testing the maximum thermometer it will be necessary to tap the bottom of it on the bottom of the vessel in which it is tested to bring the mercury down to the temperature of melting ice, care being taken not to break the instrument during the operation.

Corrections will not be made for instrumental errors without authority from this Office.

* In reading the thermometer it is necessary to place the eye in the line perpendicular to the scale at the top of the mercurial column, or top of the index of the minimum thermometer. In order that the observer may know when his eye is upon said perpendicular he must place his eye in such a position that he may see a portion (about one-half in width) of the scale through the clear portion of the thermometer tube. He will then observe that the portion of the scale as seen outside, and that as seen through the clear portion, of the tube appear to meet at but one point of the scale. At said point the perpendicular from the eye to the scale strikes the scale. Should said point not be at the top of the mercurial column or index, the eye must be moved until they coincide.

MAXIMUM THERMOMETER.

54. The board which accompanies the maximum and minimum thermometers must be securely fastened with screws, in a horizontal position, upon the transverse bars which support the wet bulb and exposed thermometers in the instrument-shelter.

55. For the support of the maximum thermometer, the long brass pin with a nut will be screwed into the board, in the hole to the extreme right. The nut will be taken off and the pin slipped through the hole in the upper end of the instrument, which must be securely fastened by replacing the nut and screwing it tightly. The plain brass pin is then inserted in the hole at the left of the board, and the thermometer placed upon it so as to slightly incline in that direction.

The end of the pin to which the maximum is attached must be occasionally oiled to prevent friction. In case the pin should become worn so as not to fit closely, a new one must be applied for.

The maximum temperature is obtained by noting the number of degrees upon the scale at the top of the column of mercury.

56. After making an observation the observer must remove the pin at the left, and, taking hold of the thermometer about three inches from the top, spin it around several times, or until the top of the column is brought down to the temperature of the air at the time of observation. Care must be taken not to touch the bulb, and also that the nut is screwed up sufficiently tight to prevent the instrument from striking against the side of the board to which it is fastened. After adjustment, gradually raise the instrument to a horizontal position, and insert the pin as before.

Care must be taken in elevating the thermometer not to raise the bulb too high, as the column of mercury would then run to the upper end of the tube.

This instrument must be read daily at all stations at the time of making the 11 p. m. (Washington time) observation, and then be set for the next night's observation; when a reading is taken at any other time, care must be taken not to change the reading of the instrument.

At all stations east of the Rocky Mountains during the months of May, June, July, August, and September a reading of this instrument will be taken at the 3 p. m. (Washington time) observation, and sent with the telegraphic report to this office as provided for in Signal Service Orders No. 21, series 1881.

MINIMUM THERMOMETER.

57. The brass support for the minimum thermometer will be screwed into the upper part of the board, and the holes so arranged as to slightly incline the left end of the support downward.

The top of the thermometer will be fastened by the small brass screw upon the support, while the lower end will be dropped into the notch to the left.

Upon receipt of a minimum thermometer at any station, it must be carefully compared with an exposed, and if any portion of the spirit is detached from the column, the column must be reunited in the following manner: pass a cord through the small hole in top of scale and tie it securely. Wrap the other end of this cord around the first finger, care being taken to have the length of cord between the thermometer and finger sufficiently short to prevent the former from striking the floor, wall, or other object, when revolved. Then commence slowly revolving or swinging the instrument in a vertical plane, gradually increasing the speed of the revolutions. In from twenty to thirty seconds the broken

column of spirits will reunite. Care should be taken to have the cord securely fastened both about the instrument and the finger. Test the thermometer in the usual way after the column has been reunited and determine the error, if any.

If this method is not successful the bulb will be immersed in warm water, care being taken not to break the bulb by heating it too suddenly.

After fastening the top of the instrument upon the support the lower end will be raised until the top of the small index touches the top of the column of spirit.

The instrument is read by observing the number of degrees upon the scale where the top of the index rests. After taking a reading, the bulb or lower end of the thermometer should be elevated until the index touches the top of column, when the instrument will be dropped into the notch at the left of the support, as before.

The minimum thermometer will be read at the 7 a. m. and 11 p. m. (Washington time) observations. At the 7 a. m. observation, care must be taken not to disturb the index, which will be set at the time of taking the night observation only. The minimum temperature at the time of making the 7 a. m. observation will form a part of the regular telegraphic report from stations specified in Signal Service Orders No. 21, series of 1881.

WATER-THERMOMETER.

58. The apparatus for noting the temperature of the water consists of a small thermometer inclosed in a cylindrical metallic case. A portion of the case is hinged so as to be swung open when it is desired to read the thermometer. A valve at the bottom of the case admits the water as it sinks to the bottom of the river or lake, and, falling into place when the case is drawn up, prevents the water from escaping.

59. At stations provided with this thermometer one observation will be made at 2 p. m. (Washington time), daily, of the exposed thermometer and the temperature of the water at the surface and bottom of the lake, bay, or river upon which the station is located.

The observer will select some convenient point on the shore (a wharf or pier, when practicable) where a sufficient depth of water exists to give a positive difference between the surface and bottom temperatures, and will provide himself with enough strong cord to reach the bottom at the place selected. One end of this cord will be securely fastened to the wire handle at the upper end of the cylinder inclosing the thermometer.

In making the observations, the observer will first note the temperature of the air as shown by the exposed thermometer in the shelter; then that of the surface-water by immersing the thermometer in the upper stratum of water, allowing it to remain long enough therein for the mercury to acquire the temperature of the water; and then, lowering the cylinder slowly to the bottom, will allow it to rest there long enough to fill, after which it will be quickly drawn to the surface, and the temperature shown by the thermometer carefully noted.

The water will be poured out of the cylinder after each observation, and the thermometer thoroughly dried.

These observations will be recorded on Form 115.

WET-BULB THERMOMETER.

60. The wet-bulb thermometer will be placed in the same shelter as the exposed thermometer, as shown in Figure 1. The cistern will be kept supplied with pure rain-water at all times when the temperature of the

air is above the freezing point, and the cover of the bulb must be changed every month and the bulb carefully cleaned. The cover may be washed as often as necessary, without removal, by means of a jet of clean water from a small syringe.

When the temperature of the air is below the freezing point, the wicking must be removed and water must be emptied from the cistern. In making an observation the wet bulb will be moistened with cold water (applied with a camel's hair brush), and the instant the mercury has reached its minimum its height will be noted.

The relative humidity and dew point are obtained from tables I to VI, inclusive.

Tables I-V give the temperature of the dew point for the actual pressures 30.00, 27.00, 24.00, 21.00, and 18.00 inches. The vertical argument, as given in the left-hand column of each page, is the temperature of the air or the reading of the exposed or dry-bulb thermometer (t). The horizontal argument, as given at the top of each page, is the depression of the wet-bulb thermometer (t') or the difference ($t-t'$) between the readings of the dry and wet-bulb thermometers.

61. The actual barometric pressure at the station will determine which of tables I-V is to be used: select always the table for the nearest actual pressure. The supplementary tables on pp. 1 and 3 of tables I-III will be used for the few cases to which they are applicable.

Table VI gives the relative humidity for all pressures. The vertical argument is the temperature of the air (t). The horizontal argument is the depression of the dew point (d) or the difference ($t-d$) between the readings of the exposed thermometer and the dew point; the latter will be obtained from the preceding tables I-V.

EXAMPLES.

1. Actual pressure 27.36 inches, the exposed thermometer reads 57° F., the wet-bulb thermometer 48° F. Find the temperature of the dew point and the relative humidity.

Air temperature, $(t) = 57^{\circ}$
 Wet-bulb reading, $(t') = 48^{\circ}$
 Depression of the wet-bulb, $(t-t') = 9^{\circ}$
 From table II, for 27.0 in. we obtain dew point $(d) = 38^{\circ}$
 Depression of the dew point, $(t-d) = 19^{\circ}$
 From table VI we obtain relative humidity, $= 49$ p. ct.

2. Actual pressure 28.20 in., the exposed thermometer reads 26° , the wet-bulb thermometer 19° . Find the temperature of the dew point and relative humidity.

Air temperature, $(t) = 26^{\circ}$
 Wet-bulb reading, $(t') = 19^{\circ}$
 Depression of the wet-bulb, $(t-t') = 7^{\circ}$
 Dew point, $(d) = -9^{\circ}$ by table I, for 28.0 in.
 Depression of the dew point, $(t-d) = 35^{\circ}$
 Relative humidity, $= 20$ p. ct. by table VI.

Special tables, for determining the dew point at the several stations, will be furnished as required.

Special care must be taken to keep the wet-bulb clean and properly moistened, and to make the observations and deductions accurately, as the humidity of the air forms an important element in all calculations of atmospheric changes.

ANEMOMETER.

62. The anemometer must be fixed in a vertical position upon the telescopic rod, the upper joint of which must be run up to its full extent, or, when this rod has not been furnished, upon a post of sufficient height to expose it to the full force of the wind. When possible, this post should be framed into the roof to steady it and prevent the instrument from vibrating; but when this cannot be done, it should be framed at the bottom into two pieces of scantling, not less than three feet in length, crossing each other at right angles, which can be nailed fast to the roof or platform upon which the instrument is placed. Short braces must be added, when necessary, to insure steadiness. The outer dial of the instrument is graduated in miles and tenths of miles, the figures 1, 2, 3, &c., indicating miles, and the subdivisions tenths. One complete revolution of this dial is equivalent to ten miles of wind. This anemometer registers up to nine hundred and ninety miles.

63. Observers will assure themselves by making a daily comparative reading that the record of the dials and that of the self-register agree at the time of changing the record-sheets on the self-registering attachment at midday. In order to take this reading the upper joint of the anemometer rod must be lowered, and raised after the reading has been taken. The dial reading will be recorded in the Original Record of Observations. When a discrepancy is found to exist between the two records, the condition of the battery should first be examined, then the wires should be detached from the anemometer and connected together; the recording instrument can then be tested and the armature adjusted to respond to the strength of the battery; after this test, should the recording instrument still fail to correspond with the dial reading, the anemometer must be carefully examined as to the condition of the dial-pegs or contact-pins (which should always be perfectly straight) and the contact springs. The latter are liable to become corroded by the action of the electric spark or moisture, and must be kept clean and dry. When found, the defect should be remedied, and the cause of such discrepancy briefly explained by a marginal note on the sheet for the date, or dates, on which the discrepancy occurred. Should an anemometer be found to admit moisture, melted beeswax must be applied to the joints. The insulated wires running to the anemometer must not be twisted around nails, or other fastenings, but tied to the necessary supports by short pieces of insulated wire.

64. Anemometers must be kept carefully and thoroughly oiled, to prevent friction and injury to the several bearings. Suitable oil for this purpose will be supplied from this Office upon application, and none other must be used after its receipt.

In making requisition for broken or defective portions of the anemometer, they must be designated by their appropriate letters, as shown in Plate No. 1, and the official number of the anemometer for which they are intended must always be given.

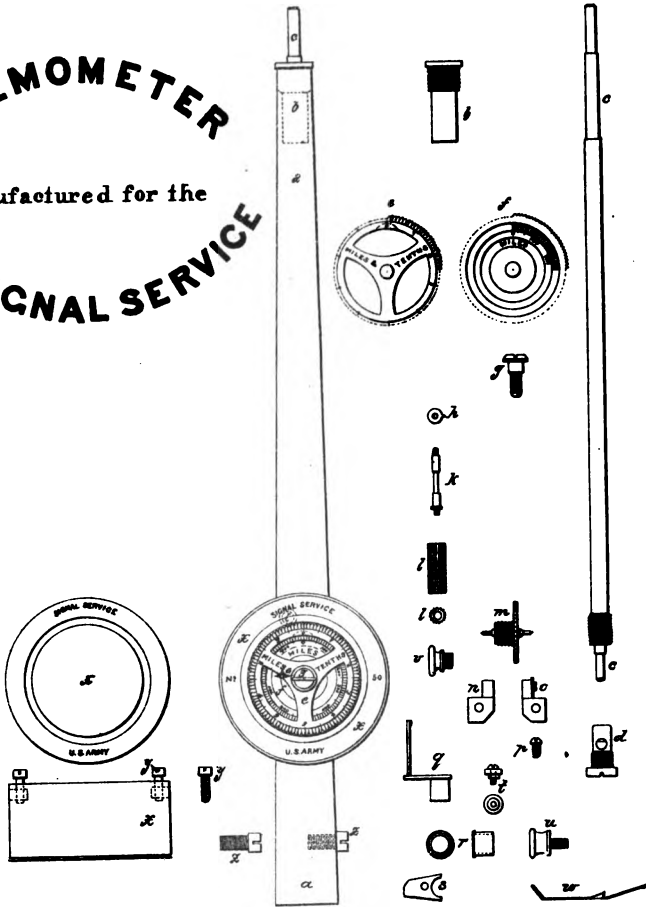
The screw-posts must be kept bright where they form connection with the conducting wires, to prevent resistance to the passage of the current.

Special attention will be given to the large dial-screw, and when found loosened it will at once be tightened, but care must be taken not to screw it up tight enough to interfere with the free motion of the dials.

65. The outer dial has one hundred and the inner dial ninety-nine divisions. As the dials are moved by the same wheel, they will move

Plate 1.

ANEMOMETER
Manufactured for the
U.S. SIGNAL SERVICE



forward one hundred divisions in the same time (Fig. 4). The outer dial having one hundred divisions, the inner dial will complete one revolution and its zero be one division beyond or to the left of the zero of the outer dial when the outer dial has completed one revolution, the zeros of the scales coinciding at the time the instrument was set in motion. Thus the revolutions made by the outer dial are recorded on the inner one, the number of revolutions being shown by the number of divisions of the scale on the inner dial between the zero of that scale and the zero of the outer one. In taking the reading of the anemometer at any time the hundreds and tens of miles are read from the inner scale, and the units and tenths of miles are read from the outer one. Take from the inner scale the hundreds and tens of miles contained between the zero of that scale and the zero of the outer one, and the units and tenths of miles on the outer scale contained between the zero of that scale and the index of the instrument, and the sum of these readings will be the reading of the instrument at the time of making the observation.

When the anemometer is not furnished with an index-point, the center of the small wheel which gives motion to the dials will be taken as the reference point.

66. To obtain the velocity of the wind for the regular observations when the self-registering attachment is out of order, two readings of the outer dial must be taken with an interval of five minutes

between them, and the *difference* between these readings will be the distance in tenths of miles traveled by the wind in that interval. This, multiplied by twelve, will give the proximate velocity in miles per hour. Example: suppose the index of the anemometer to be at 3 on the outer dial when the first reading is taken, and at 3.6 five minutes after, the difference, .6, is the distance traveled in that time; and this, multiplied by twelve, gives a velocity of seven and two-tenths miles per hour.

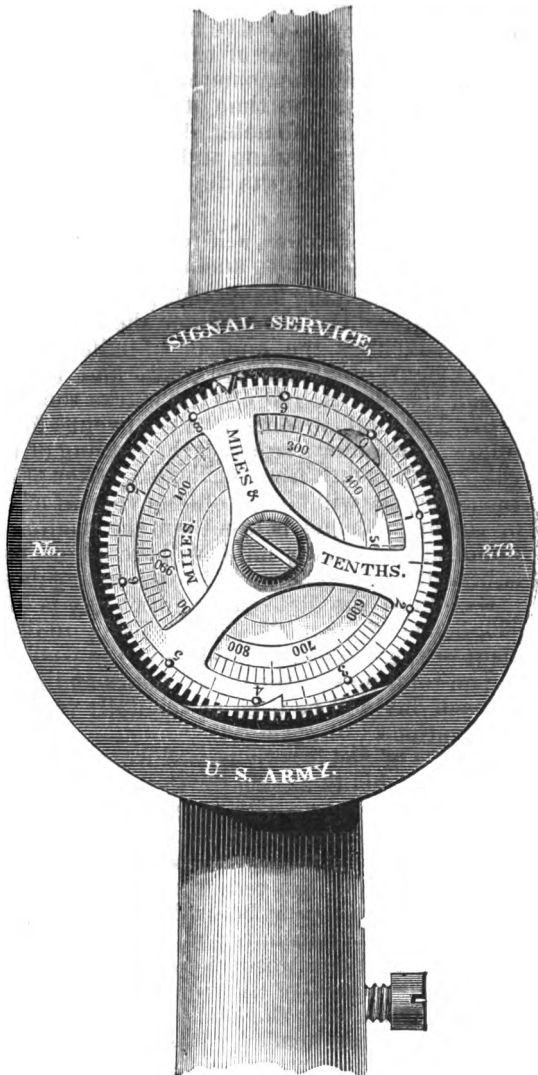


Fig. 4.—ANEMOMETER DIAL

Whole numbers only will be used in expressing the velocity; when the decimal is *greater* than five-tenths, the unit's figure will be increased by one; when *five or less* it will be thrown out.

The maximum hourly velocity of the wind when the self-registering attachment is used will be determined by multiplying the number of miles, recorded in the fifteen minutes in which the maximum occurred, by four, and, when the dial-readings are used, by multiplying the highest velocity in a period of five minutes by twelve.

The total movement of the wind in the preceding twenty-four hours, as shown by the anemometer, will be noted by the observer daily at 12 noon, local time (the time of changing the anemometer sheets), and recorded on the anemometer sheets. Upon the anemometer sheets will be recorded the dial-reading and the total movement of the wind taken from the self-register and the dial-readings, in the following manner:

Dial-reading	567
Total number of miles, self-register	243
Total number of miles, anemometer dials	243

The quarter-daily movement (number of miles) will be recorded on the left margin of the anemometer sheets.

In reckoning the number of miles recorded by the self-registering attachment, observers will count and record the number of spaces between the marks, and not the marks themselves.

67. The total movement for the twenty-four hours will be obtained in the following manner: subtract the reading of the anemometer at 12 noon, of the preceding day, from the reading taken at 12 noon of the current day, and the difference will be the total movement of the wind. When the reading of the anemometer is less than the reading of the preceding day, nine hundred and ninety miles will be added to it, and the remainder after subtracting the reading of the preceding day, will be the total movement.

Example: the dial reading of to-day is 91, and that of yesterday was 950, hence we have $91 + 990 = 1081$; $1081 - 950 = 131$, the total movement of the wind in miles during the past twenty-four hours.

The total movement for 24 hours ending 11 p. m. (Washington time) of each day will be used as the daily velocity on all forms, records, and publications.

In case of the loss of record from the anemometer sheets, for one or more days, blank sheets for the period during which the record is missing must be filled up with the name of station, proper dates, and, on each, a remark explanatory of the cause of the loss of the record, and forwarded with the regular weekly package to this Office.

All entries on the record sheets, except the record marks made by the self-register, must be made in ink instead of lead pencil.

Whenever a station is not supplied with an anemometer or the anemometer becomes unserviceable, and fails to record the movement of the wind, the force of the wind must be estimated and reported as Light, Gentle, Fresh, etc., the designation being taken from the column in the telegraph cipher headed "Designation of Wind Force."

The instrument must not be taken apart unnecessarily, and those having the new style of contacts must be handled with especial care.

Observers must familiarize themselves with the construction of the several parts of the anemometer, in order that they may be able to locate faults whenever the instrument is out of order.

ELECTRIC SELF-RECORDING ANEMOMETER ATTACHMENT.

68. The following directions for setting up and the general management of the electric self-recording anemometer attachment, adopted by this Office, will be observed at all stations supplied with the apparatus

Near the top of the post or telescopic rod, on which the anemometer is fixed, fasten the wires separately, leaving just sufficient of the upper end of each wire to reach to the outside ends of the contact-screws A and B (Fig. 5), to which they must be securely fastened. Then pass the lower ends of the wire down the post, over the roof and down the side of the house (secured by pieces of insulated wire so that the wind will not sway them), to the top of the office-window; pass them in through two small holes (where the sash and shutters will not injure them), and down the inside. In crossing the roof, it is well to fasten them between two wooden strips one on top of the other. One wire must then go to the binding-screw H (Fig. 6), and the other to one pole of the battery. Then, from the other pole of the battery, run a wire to the binding-screw K, when the circuit is completed, and the armature will be closed once for each mile the wind travels.

Particular care must be taken that all of the connections are firmly made.

69.—*For putting on the paper.*—Place the cylinder S on a table in front with the screw T to the left hand; place the paper on the cylinder, with the top of it from the screw. Let the line marked 12 m. (noon) come on the line marked on the cylinder, and place a rubber band on each end. The lines at each end of the paper will then exactly coin-

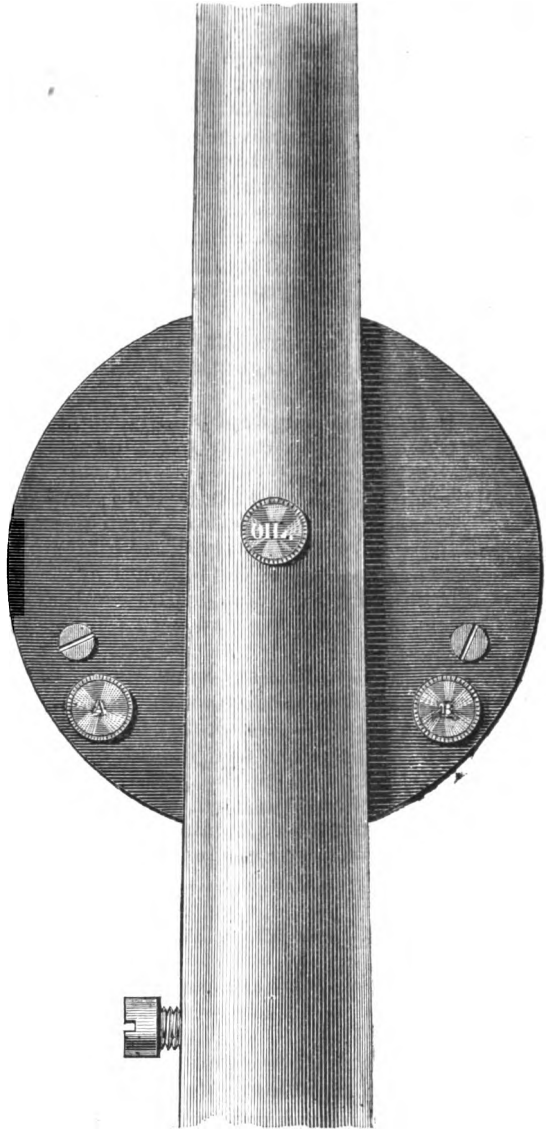


Fig. 5.—STANDARD ANEMOMETER, SHOWING CONTACT SCREWS.

Place the cylinder S in its position, so that the end opposite the screw T will be near the post on which it rests. Slide the small sliding-bar on the horizontal bars O O until it fits on the ends of the screw-axle T; then revolve the cylinder until the pencil rests on the end of the upper line, marked 12 m., and tighten the thumb-screw N.

To regulate the length of the mark, adjust the armature set-screw P

until the pencil mark is one-eighth of an inch long, when the armature is moved back and forward; then turn thumb-screw Q until the pencil point rests on the line marked 12 m.; should the movement of thumb-screw Q be insufficient to bring the pencil point to the line the paper on the cylinder must have a piece cut from one side and shifted towards that side necessary to bring the pencil on the line. When the spring that holds the pencil to the cylinder is not sufficiently strong to produce a clear and distinct mark on the paper it must be strengthened by shortening the spring; but care must be taken that it is not stiffened so much as to prevent the free movement of the armature when the circuit closes. Should the pencil-point not make a distinct mark on the record-sheet the pencil must be soaked in oil, or a softer one used. The best kind of oil for this purpose is sperm. When the sheets are too long to fit the cylinder exactly, strips of paper must be wound around the cylinder until its circumference is increased sufficiently to make the lines of 12 m. and 6 p. m. coincide, care being taken to keep the surface smooth and even.

In adjusting the armature-spring care must be taken not to make it too strong for the magnet, and still strong enough to draw back the pencil in a straight line.

The pencils must be kept pointed enough to give a clear, distinct mark.

The clock must be wound every day, when the record is changed.

The record must be changed daily, at 12 m. (noon).

At stations furnished with the self-recording apparatus, the hourly velocity of the wind will be deduced from the record of the 15 minutes (multiplied by four) immediately preceding the time of observation. In case the cups are moving at the moment of observation and the anemometer has not closed the circuit during said fifteen (15) minutes, but during the preceding hour, the number of miles will be taken from the whole hour preceding.

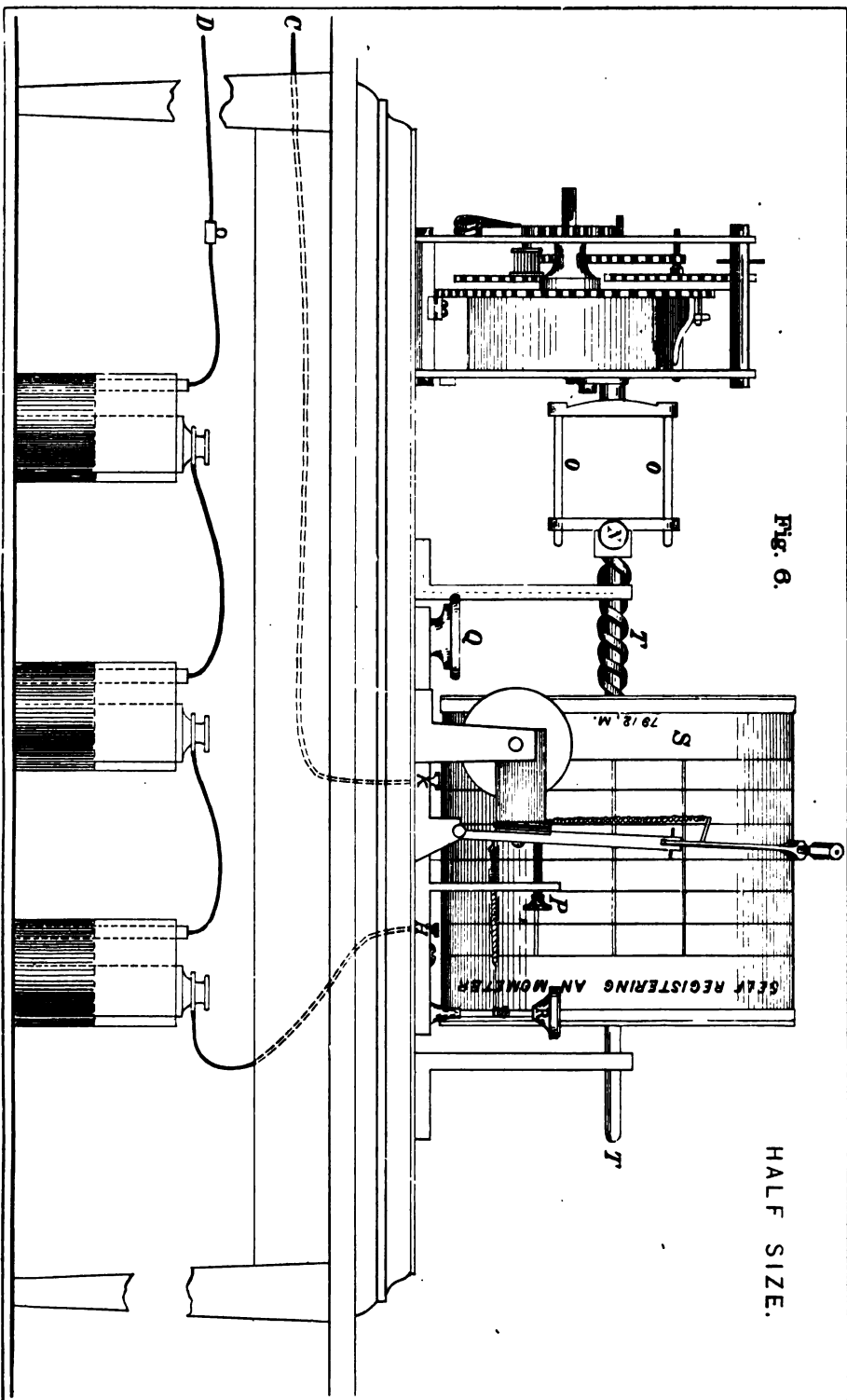
70. Anemometer sheets must never be folded previous to transmission by mail, but made into a compact roll, which will be securely bound between the other weekly forms. This roll must have the address of this office upon it so that in case of loss from the package its destination may be known to the postal authorities. Each weekly package must contain the sheets from 12 noon of one Saturday to 12 noon of the succeeding Saturday. In preparing them for the mail, care must be taken not to fold over the ends before rolling, as so doing injures them for binding.

RULES FOR REGULATING CLOCK OF SELF-REGISTER.

71. If the clock varies less than 10 or 15 minutes a day: if too slow, turn regulator R to the "left"; if too fast, turn regulator R to the "right" (Fig. 7).

When it varies 20 or 30 minutes a day: if too slow, take out pin P and set end of spring farther into the hole; if too fast, take the spring farther out of the hole where held by P.

When it varies over thirty minutes a day: set the regulator R in the center, and, if too slow, tighten the three screws S S S of the balance wheel equally; if too fast, loosen the three screws equally. In both cases allow about one turn for every 30 minutes' variation. If the escapement pin E vibrates more on one side of the forks of the lever L than on the other, the hair-spring must be brought either to right or to left on the axis, which can be done by inserting a small screw-driver into the slot W to hold it in position while turning balance-wheel in the desired direction.



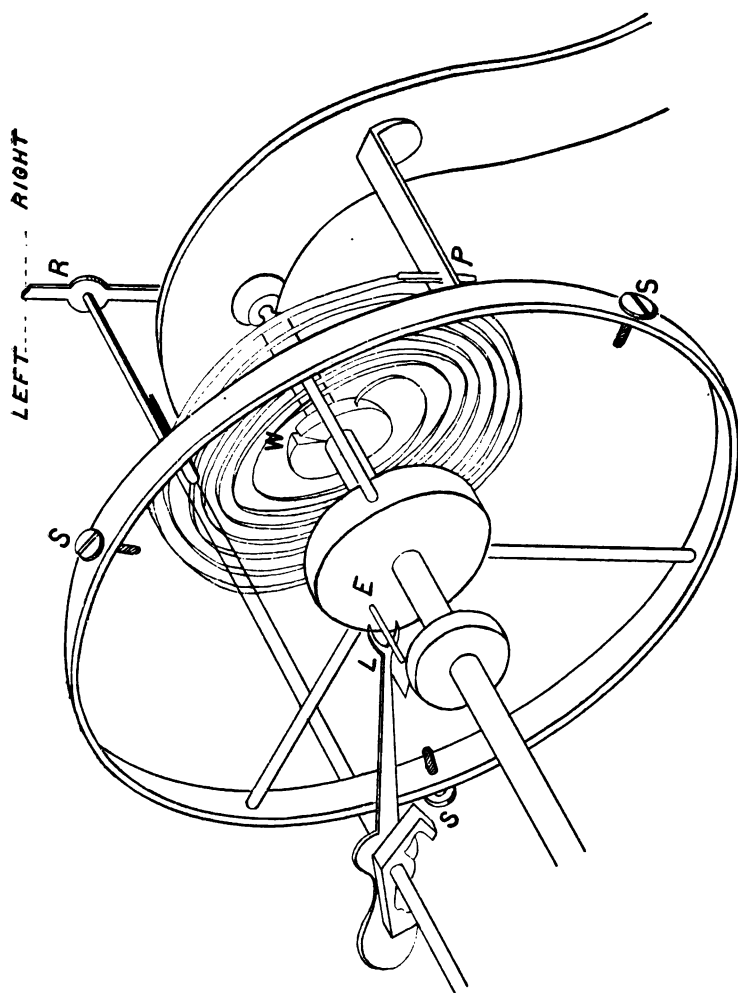
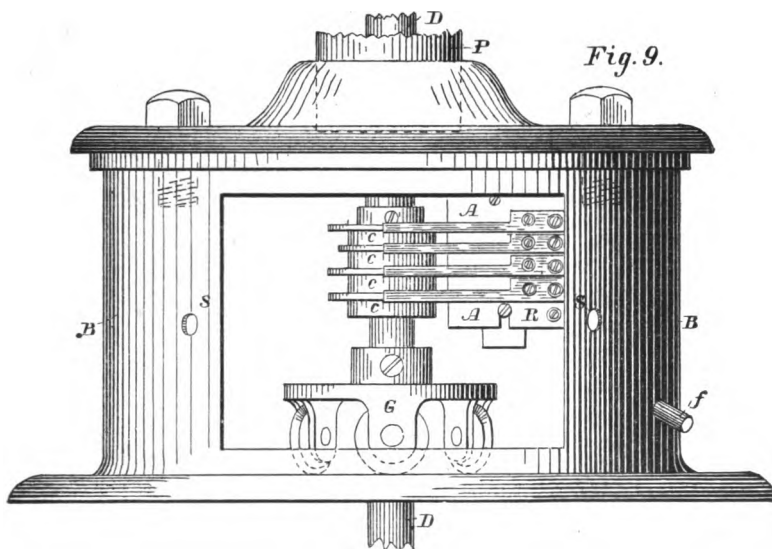
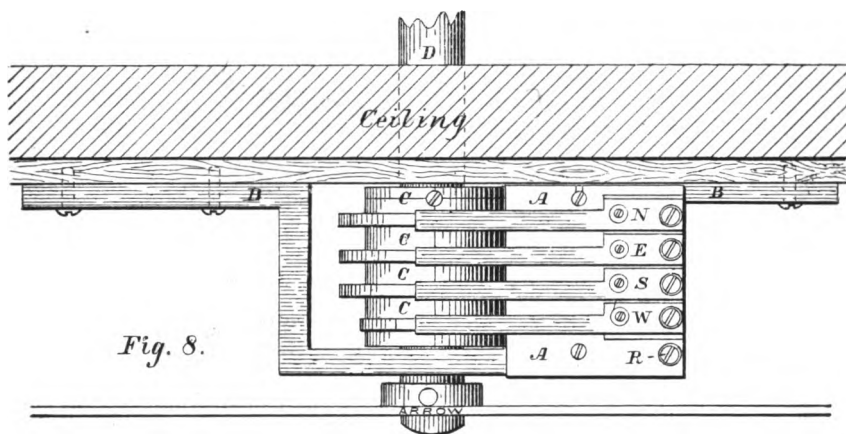


Fig. 7.



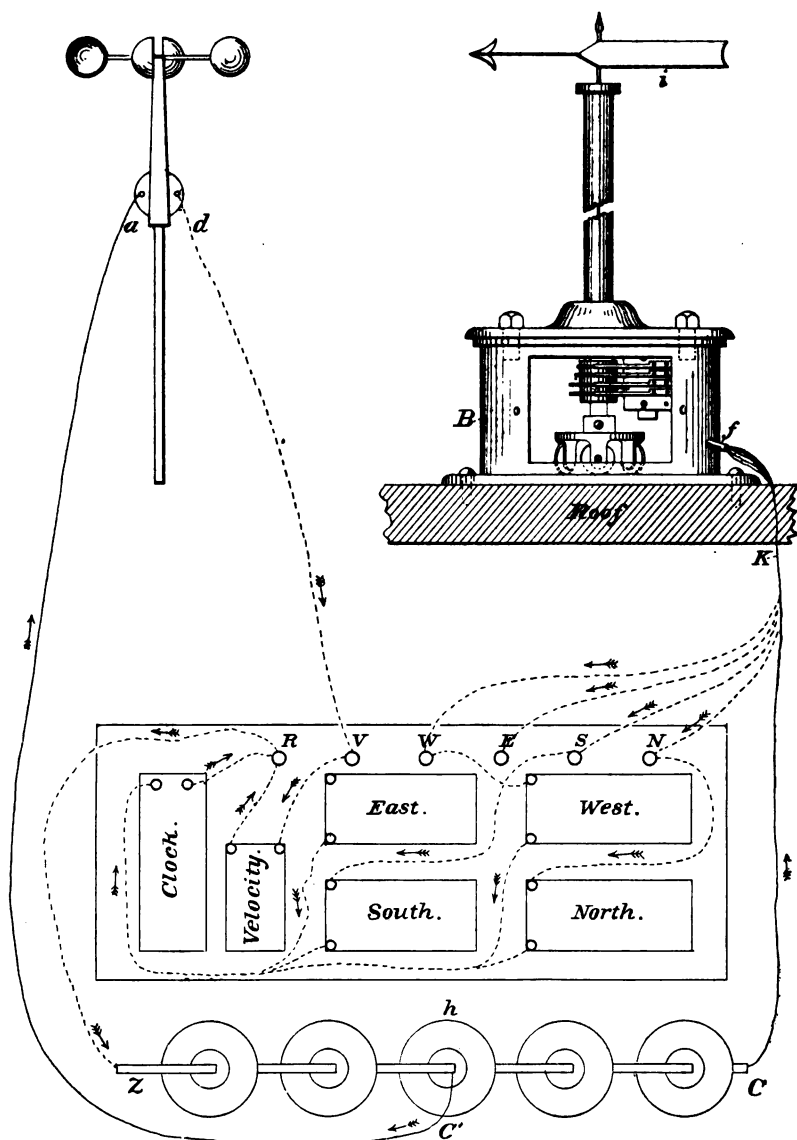


FIG. 10.—Anemometer and anemoscope circuits combined.

**DIRECTIONS FOR SETTING UP THE ANEMOGRAPH (DOUBLE REGISTER)
WITH THE ECCARD CONTACT.**

72. Fig. 8 shows the position of the contact when the vane-rod passes through the roof to the ceiling of the office.

Fig. 9 shows the position of the contact and of the friction rollers when inclosed in a cast-iron base on the roof of a building.

Fig. 10 shows the courses of the different circuits from the anemometer and anemoscope through the registering attachment to the battery.

To place the contact in position, as shown in Fig. 8, the vane rod must be placed so as to extend from three and one-half to four inches below the ceiling, and the following directions be carefully observed:

1st. Fasten the circuit closer *c, c, c, c* (Fig. 8) to the vane rod, with the set screws close to the ceiling, and then pass the end of the rod through the aperture in the lower side of brass support, *B, B* (Fig. 8), which must be securely fastened to the ceiling.

2d. Screw the brass plate *A, A*, with which the four contact springs *N, E, S, W* are connected, to the support *B, B* (Fig. 8) in such a manner that the contact springs will be parallel with and opposite to their respective cams on the circuit closer *c, c, c, c*.

3d. Adjust the circuit closer *c, c, c, c* (Fig. 8) by having an assistant hold the wind-vane in a due north direction; loosen the set screws of the circuit closer *c, c, c, c*, and turn it around until the point of the spring *N* corresponds with the notch filed in the uppermost cam on the circuit closer opposite to the spring *N*. When this has been done, firmly re-fasten the circuit closer to the vane-rod by means of the set screws.

4th. Before connecting the five-wire cable test it, and mark the wires *N, E, S, W*, and *R*, respectively, at *both* ends. Remove the covering from the cable, for at least six inches, at the end to be connected with the contact, clean the ends of the wires, connect them with the five binding posts at the ends of the springs *N, E, S, W*, (Fig. 8), then fasten the cable to the ceiling and conduct it to the instrument by the most practicable route, where the four wires *N, E, S, W*, will be connected with the binding screws *N, E, S, W*, shown in Fig. 10. The fifth wire, *R*, must be connected with one pole of the battery *c, c, z*, as shown in Fig. 10.

5th. Connect the other pole (*z*) of the battery with the binding screw *R*. (See Fig. 10.)

6th. When it is desired to work the anemometer circuit with only a part of the battery, the wire from the binding screw *a* on the anemometer is led to any one of the battery cells. (The number of cells to be used will depend upon the length of the anemometer circuit.) The current of all the cells in the battery will, however, be brought into action when the direction circuit is closed, at regular intervals, by means of the clock contact. The other wire, *d*, is led from the anemometer to the binding post *V* on the recording instrument. (See Fig. 10.)

7th. When all the wires have been properly placed, the arrow or indicator must be screwed to the vane-rod immediately under the lower portion of the brass support *B, B* (Fig. 8).

Where an office is so located that the vane-rod cannot be passed through the roof to the ceiling, a cast-iron base, *B, B*, Fig. 9, will be furnished. A suitable wooden block will be firmly fastened to the roof upon which the cast-iron base will be securely attached. The lower end of the pipe *P*, through which the vane-rod passes, will be placed in the socket in the top of the cast-iron base, and the vane-rod itself, *D, D*, passed through the two apertures in the top and bottom of the base

B, B, and through the wooden block underneath the base. A hole should be bored in the wooden block of greater diameter than the vane-rod in order to prevent friction. In erecting the vane care must be taken to place it at such an elevation that the vane-rod will not extend too far below the iron base. After the large pipe, P, supporting the vane is firmly braced to the roof, and before the vane is attached to the rod, the contact-friction rollers, G, must be placed in position. This will be done by raising the vane-rod sufficiently to enable the circuit closer *c, c, c, c* and friction rollers, G, to be slipped on the lower end of the rod. Lower the rod to its former position so that the upper friction rollers (which are immediately below the vane) will rest upon the cap of the pipe. Then fasten the lower friction rollers, G, to the vane-rod D, D, so that the weight of the rod will be as equally distributed as possible between the upper and lower friction rollers. Place the circuit closer *c, c, c, c* and plate, A, A, in position. (See Fig. 9.) Pass the cable K (Fig. 10) through the small pipe *f* (Figs. 9 and 10), and connect the wires in the manner heretofore described.

BATTERIES.

73. Two forms of battery are used in the Signal Service, both of them being modifications of the well-known Daniell's battery. The following instructions for setting up and managing them will be observed at the different stations:

THE FIELD-BATTERY.

74. 1st. In putting the battery together for use, place the porous cup inside the copper vessel, and the star-shaped zinc element inside the porous cup.

2d. Fill the copper vessel with a strong solution of sulphate of copper (prepared in another vessel by dissolving about half a pound of crystals of the sulphate in a quart of pure water) to within one inch of the top. *Crystals of the sulphate must never be plunged in the copper vessel, neither must sulphuric acid be used to strengthen the battery, as by so doing the copper vessel will be rapidly destroyed. The porous cup will then be filled with pure water to within one inch of its top.*

3d. After all the cells are filled in this manner, connect the copper (positive) pole of one cup with the zinc (negative) pole of the next one by short pieces of insulated copper wire, using the copper clamps for attaching the ends of the wires to the zincs, and the fixed binding-screws for attaching them to the coppers. The main wires, through which the circuit is formed, will be attached to the copper and zinc elements of the outside or end cups, respectively.

4th. A battery carefully put up in this manner should work with but slight diminution of force for at least fourteen days, *at the end of which time the porous cups must be taken out, emptied, washed thoroughly, and all pure copper on their outer sides removed, and then refilled with pure water.* Care must be taken to avoid disturbing the paraffine at the bottom of the cups, as it is placed there to prevent contact between the zinc and copper elements. The zincs must be thoroughly cleaned with the battery-brush provided for that purpose.

5th. The liquid in the copper vessels must not be changed as often as the water in the porous cups, but only when it loses its dark-blue color. It must be stirred daily, in order to keep it of equal strength above and below, as the sulphate held in solution has a tendency to settle to the

bottom, on account of its greater specific gravity, thereby localizing its action.

6th. The binding-screws and the ends of the small connecting-wires must be kept scrupulously clean to insure good connections, and the copper vessels kept at least one inch apart to prevent contact. The cells should rest on a *painted* wooden base, to insulate them from each other and from the earth, and care be taken to prevent any escape of liquid from the several cells by which a connection might be formed between them.

7th. The copper vessels must be kept properly painted on the outside.

EAGLE BATTERY.

75. 1. Arrange the cells in order, and make the proper connections.

2. Place in each cell five pounds of sulphate of copper.

3. Cover the sulphate of copper with a layer of sawdust one inch thick.

4. Place the zinc plate upon the sawdust.

5. Pour in sufficient water to cover the zinc plate or to fill the jar within an inch of the top of the cell.

6. Connect the cells together in short circuit, and let them stand for several hours to develop strength before using on line.

7. The wooden or rubber strips are intended to prevent the zinc from coming in contact with the lead cell, and must be placed in an upright position within the cell, and the lead tips bent over the cells to keep the strips in place.

8. The zinc plates must be kept covered with water.

The copper wires of the *zincs* must not be uncoiled until needed, and then only so far as may be necessary to prevent breaking them off.

In making requisition for additional *zincs* for this battery, observers will state whether the round or square kind are needed.

76. The observer in charge of a station must personally examine the batteries in use on station each Saturday, and must cause the cells of the main and local batteries to be carefully wiped off with a moist cloth. Should any cell be found to leak it must be at once removed and repaired before being replaced.

The fact that this order has been carried out, and the dates on which the batteries are cleaned, must be noted in the Daily Journal and reported in the Abstract.

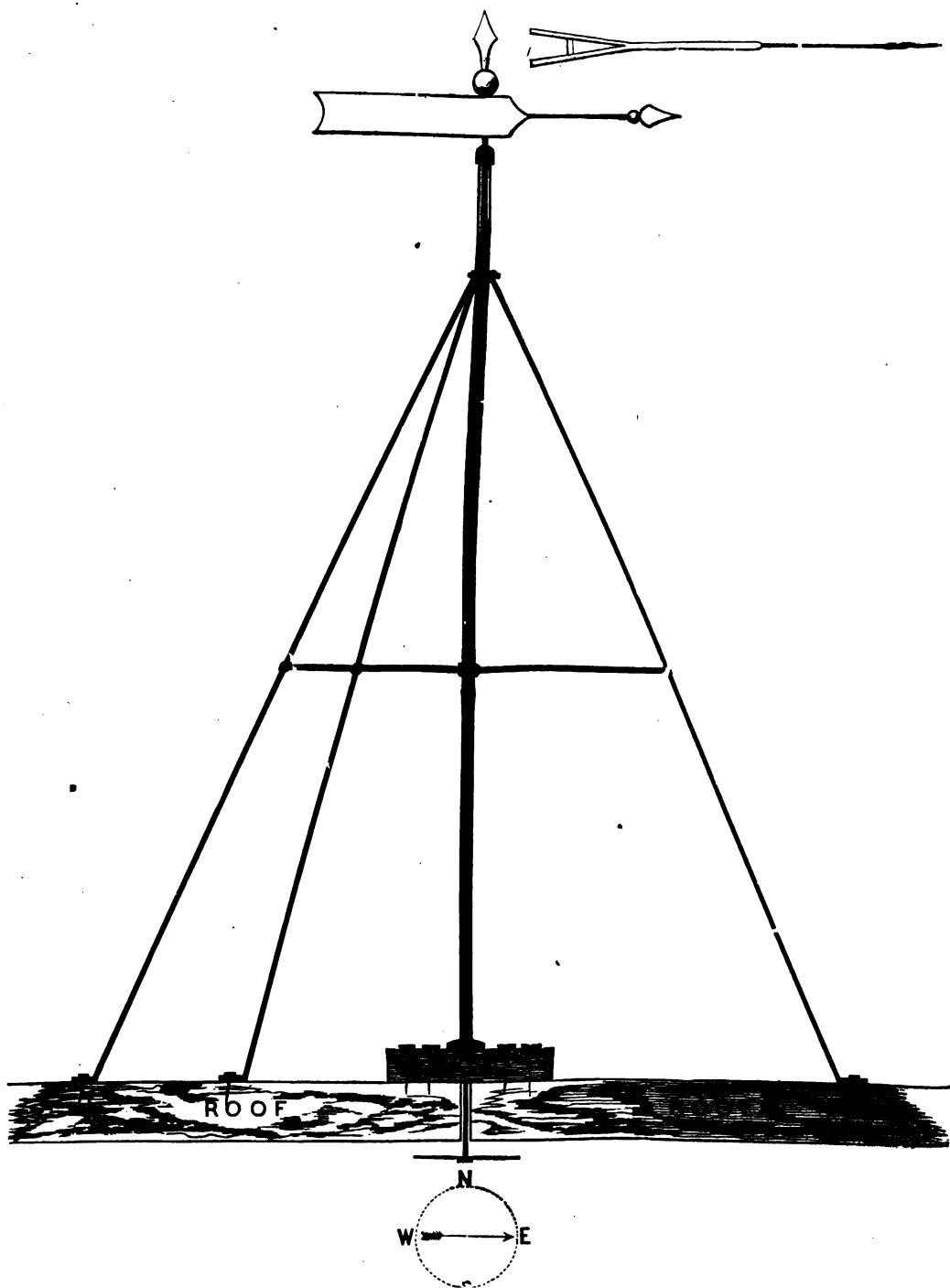
Enlisted men in charge of stations must take special care to see that the floors of the rooms occupied at the station are not injured by the batteries in use.

The batteries will be placed in wooden troughs made water-tight, and as soon as a defective cell is discovered it must be removed. A coating of oil must be applied to the outside of the battery cells to delay the formation of crystals thereon.

WIND-VANE.

77. Two wind-vanes are furnished to each station; a small one to be sent with the original station supplies for immediate use, and a larger one, or standard, to be sent as soon after the station is opened as practicable. When the latter has been received and placed in position, the small one will be removed, and carefully stored by the observer for use in cases of emergency.

78. The vane used for determining the direction of the wind must be set where the wind may act freely upon it, and must never be sheltered by surrounding buildings or other objects. Where the vane-rod does



Face p. 35.

Fig. 11.

not pass through the roof to the office, the observer must mark upon a wooden dial, at the base of the upright which supports the vane, the true meridian and cardinal points of the compass.

At stations where the rod connected with the standard wind-vane passes through the roof and indicates the direction of the wind by an arrow in the office-room, the arrow must be adjusted to correspond exactly in direction with the vane itself, and, when such adjustment has been made, the arrow must be securely fastened by means of the set screw, forwarded from this Office for that purpose.

A competent mechanic will be employed to perform such part of this work as cannot be done by the observer, and his bill forwarded for settlement in the usual manner.

When the large vane is received at any station, it will be immediately erected upon the building in which the office is located, provided the consent of the owner can be obtained, and the roof is strong enough to support its weight.

The general appearance of the vane and the location of the several parts are shown in Fig. 11. The iron straps which unite the two parts of the foot-block will be taken off and the block separated before raising the vane, in order to put the iron socket holding it in proper position. After the vane is up, the pieces will be fastened firmly together again by these straps.

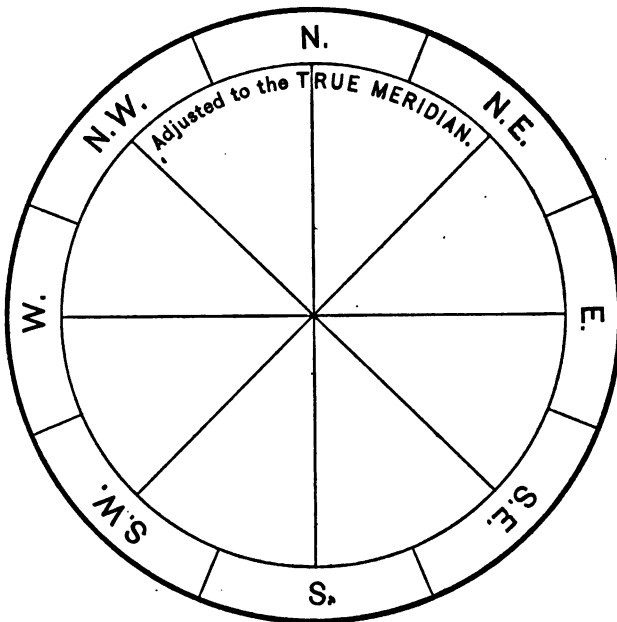


Fig. 12.—DIAGRAM FOR VANE CIRCLE.

When the office is on the upper floor, the central rod will be brought into the room, and allowed to project about four inches below the ceiling. The gilded arrow will then be screwed on, and two circles drawn around it on the ceiling a little greater in diameter than the length of the arrow. Between these circles will be painted the eight points of the compass used in the weather reports, care being taken to get the true meridian as a

starting-point. Observers must daily examine the vane and the arrow under the ceiling to see that they point in the same direction.

To fix the north and south line of the vane-circle in the "true meridian," place a table directly under the end of the vane-rod. Suspend a plummet from the center of the end of the rod. Place the compass upon the table with its center directly under the end of the plummet. If the variation of the magnetic needle is given as *east* a certain number of degrees, turn the compass until the north end of the needle reads that many degrees *east* of the N point on the face of the compass. If the variation is *west*, turn the compass until the needle reads the given number of degrees *west* of the N point. Then lay a straight-edge across the face of the compass so that it will pass through the N and S points of the face, which are in the "true meridian"; mark two points upon the table under the straight-edge; draw a straight line through these points; hold the plummet-string against the vane-circle and move it along until the plummet point crosses the straight line on the table upon both the north and south sides; mark these crossings upon the circle, which are the "true" N and S points.

These instructions are based upon the supposition that the compass used is marked so that when placed upon a table and the observer sights from S to N the E point is on his right hand and the W to his left. Should the E point, as marked on the compass, be to the left and the W point to the right, when the variation is given as *east* turn the compass until the north end of the needle reads the given number of degrees toward the west point; if *west*, turn it until the needle reads the proper number of degrees toward the east point.

79. At all stations supplied with the standard wind-vane, with the indicator extending through the roof to the office-ceiling, the words "*adjusted to the true meridian*" will be painted inside the vane-circle, upon the ceiling.

80. When permission cannot be obtained to put up the vane, the fact will be reported at once to this Office.

81. The observation of the vane requires more care than is usually given. In winds of considerable strength the vane is never at rest or fixed in the same direction; it oscillates incessantly, and its oscillations increase in extent with certain winds and with the violence of the wind. In such cases observers must *note the mean direction* between the extremes. When the wind is too light to move the vane, and when it is calm, no direction will be recorded. The attention of observers is called to this matter, in order to prevent them from recording a direction of the wind when it is calm. The direction of the wind will be designated by the eight principal points of the compass, viz: N., NE., E., SE., S., SW., W. and NW.

82. In reporting changes in the *direction* of the wind, the terms *veering* and *backing* will be used. In the northern hemisphere the term *veering* indicates the changing of the wind from N. to E. to S., and so on, or in the direction corresponding with the movements of the hands of a watch; while *backing*, being the reverse term, indicates that it changes from N. to W. to S., and so on.

The bearings of the vane must be kept well and carefully oiled to prevent friction.

The magnetic variations at the stations now occupied is shown in the following table.

Station.	Variation east.		Variation west.		Station.	Variation east.		Variation west.	
	Degs.	Mins.	Degs.	Mins.		Degs.	Mins.	Degs.	Mins.
Albany, N. Y.			9		Eugene City, Oreg.	20	30		
Alpena, Mich.			1		False Cape, N. C.			2	30
Apache, (Fort), Ariz.	13	30			Father Point, Canada			21	
Apache Pass, Ariz.	13				Ferry Point, Mont.	18	30		
Aassiniboine, (Fort), Mont.	20	30			Florence, Ariz.	13	15		
Atlanta, Ga.	4	15			Fredericksburg, Tex.	10			
Atlantic City, N. J.			6		Gages, Mont.				
Atka, Alaska	7	45			Galveston, Tex.	8	15		
Augusta, Ga.	2	30			Garry, (Fort), Manitoba	13			
Baltimore, Md.			3	30	Gibson, (Fort), Ind. T.	9	30		
Bangor, Me.			16		Grand Haven, Mich.	4			
Barbadoes, West Indies			30		Grant, (Fort), Ariz.	13			
Barnegat, N. J.			6		Greens, Mont.				
Bayard, (Fort), N. Mex.	13				Griferson's Springs, Tex.	11			
Belen, N. Mex.	13				Griffin, (Fort), Tex.	10	30		
Bennett, (Fort), Dak.	15	15			Grinnels, Dak.	18			
Benton, (Fort), Mont.	21				Guadaloupe, W. Indies.			30	
Bismarck, Dak.	16				Halifax, Nova Scotia			20	15
Boise City, Idaho	19	15			Hatteras, N. C.			2	30
Boston, Mass.			11		Havana, Cuba	5	30		
Brackettville, Tex.	10				Helena, Mont.	20	30		
Brownsville, Tex.	8	30			Henrietta, Tex.	10	30		
Buffalo, N. Y.			3	30	Huron, Dak.	14			
Buford, (Fort), Dak.	18	30			Hunter's Springs, Mont.	19			
Burlington, Iowa.	8				Indianapolis, Ind.	4	45		
Burlington, Vt.			11	30	Indianola, Tex.	8	30		
Cairo, Ill.	6	30			Jacksboro, Tex.	10	30		
Camp Goodwin, Ariz.	13				Jacksonville, Fla.	3			
Camp Lowell, Ariz.	13				Keogh, (Fort), Mont.	18	15		
Campo, Cal.	13	45			Keokuk, Iowa	8			
Cape Henry, Va.			2	45	Key West, Fla.	4			
Cape Lookout, N. C.			1	30	Kingston, Canada			7	30
Cape May, N. J.			4	45	Kingston, Jamaica	3	15		
Castroville, Tex.	10				Kittyhawk, N. C.			2	45
Cedar Keys, Fla.	4				Knife River, Dak.	18			
Charleston, S. C.	1	30			Knoxville, Tenn.	2	30		
Charlotte, N. C.	1	15			La Beau's, Mont.	15	30		
Charlottetown, P. E. I.			23	30	La Crosse, Wis.	9			
Chatham, N. Brunswick			22		La Mesilla, N. Mex.	12	15		
Chattanooga, Tenn.	4				Lapwai, (Fort), Idaho	21	15		
Cheyenne, Wyo.	15	30			Laredo, Tex.	9	30		
Chicago, Ill.	5				Las Cruces, N. Mex.	12			
Chincoteague, Va.			3	30	Leavenworth, Kans.	10			
Cincinnati, Ohio	3				Lewiston, Idaho	21	15		
Cleveland, Ohio			0	30	Lincoln, (Fort), Dak.	16			
Clifton, Jamaica	3	15			Little Egg Harbor, N. J.			6	30
Coleman City, Tex.	10	30			Little Missouri, Mont.	18	15		
Columbus, Ohio	1	15			Little Rock, Ark.	8			
Colorado Springs, Colo.	14	30			Live Oak, Tex.	10			
Concho, Tex.	10	45			Logansport, Ind.	3			
Corrilla Station, Ariz.	13				Los Angeles, Cal.	14	45		
Corsicana, Tex.	9	30			Louisville, Ky.	4			
Coulson, Mont.	18	30			Lowell, (Fort), Ariz.	13			
Craig, (Fort), N. Mex.	12	30			Lynchburg, Va.			0	45
Cummings, (Fort), N. Mex.	12	45			Lytton, British Columbia	24			
Custer, (Fort), Montana.	18	30			Macon, (Fort), N. C.			2	30
Davenport, Iowa.	7	30			McKavett, (Fort), Tex.	10	30		
Davis, (Fort), Tex.	11				Madison, Wis.	7	15		
Dayton, Wash.	21	30			Maricopa, Ariz.	13	15		
Deadwood, Dak.	16	30			Marquette, Mich.	4	15		
Decatur, Tex.	10				Mason, Tex.	9	45		
Deer Lodge, Mont.	20	30			Meade, (Fort), Dak.	16			
Delaware Breakwater, Del.			4	30	Memphis, Tenn.	6	30		
Denison, Tex.	10				Milwaukee, Wis.	6			
Denver, Colo.	14	45			Missoula, (Fort), Mont.	21	15		
Des Moines, Iowa	9	45			Mobile, Ala.	6			
Detroit, Mich.	0	15			Montgomery, Ala.	5			
Dodge City, Kans.	12	30			Montreal, Canada			12	
Dubuque, Iowa	8	15			Moorhead, Minn.	13			
Duluth, Minn.	10	15			Morgantown, W. Va.			1	30
Eagle Pass, Tex.	9	45			Mt. Washington, N. H.			13	
Eastport, Me.			18		Nashville, Tenn.	5	30		
Edinburg, Tex.	8	45			Navassa Island, West In.	3			
Elliott, (Fort), Tex.	11	45			New Chicago, Mont.	21			
Ellis, (Fort), Mont.	19	30			New Haven, Conn.			8	30
El Paso, Tex.	12				New London, Conn.			9	
Erie, Pa.			2		New Orleans, La.	7			
Escanaba, Mich.	4				Newport, R. I.			10	15
					New River Inlet, N. C.			0	5
					New Westminster, Br. C.	24			

The magnetic variations at the stations now occupied, &c.—Continued.

Station.	Variation east.		Variation west.		Station.	Variation east.		Variation west.	
	Degs.	Mins.	Degs.	Mins.		Degs.	Mins.	Degs.	Mins.
New York, N. Y.			7		Shaw, (Fort), Mont.	20	45		
Norfolk, Va.			2	30	Shreveport, La.	8	30		
North Platte, Nebr.	14				Sill, (Fort), Ind. T.	10	45		
Ocean City, Md.			4		Silver City, N. Mex.	13			
Olympia, Wash.	22				Sloop Point, N. C.				30
Omaha, Nebr.	11				Smithville, N. C.	0	0	0	0
Oswego, N. Y.			6	45	Springfield, Ill.	6	15		
Parry Sound, Canada.			4	30	Springfield, Mass.			9	30
Pembina, Dak.	13	30			Stevenson, (Fort), Dak.	17			
Pembroke, Ontario	7				Stockton, Tex.	10	45		
Pensacola, Fla.	5	45			Stillwater, Mont.	20			
Philadelphia, Pa.			5	30	St. Andrew's, N. B.			18	
Phoenix, Ariz.	13	15			St. George, Bermuda			7	30
Pike's Peak, Colo.	14	30			St. John's, Newfoundland.			18	0
Pioche, Nev.	16				St. Louis, Mo.	6	30		
Pittsburgh, Pa.			1	15	St. Mary's, Wyo.	17			
Pomeroy, Wash.	21	30			St. Michael's, (Fort), Alas.	25	17		
Port Dover, Canada.			2	30	St. Paul, Minn.	10	45		
Port Huron, Mich.			1		St. Paul's Island, Alaska	19			
Port Stanley, Canada.			1	30	St. Thomas, West Indies.	1			
Portland, Me.			13	15	Supply, (Fort), Ind. T.	11	30		
Portland, Oreg.	21				Sydney, C. B.			25	30
Portsmouth, N. C.			1	45	Terry's Landing, Mont.	18	30		
Powder River, Mont.	17	30			Thatcher's Island, Mass.			12	
Prescott, Ariz.	14				Toledo, Ohio	1	15		
Punta Rassa, Fla.	4				Toronto, Canada			8	45
Quebec, Canada.			16	30	Tres Alamos, Ariz.	12	45		
Radersburg, Mont.	20				Tucson, Ariz.	13			
Rapid City, Dak.	16				Umatilla, Oreg.	21			
Red Bluff, Cal.	18				Unalaksha, Alaska.	19			
Reno, (Fort), Ind. T.	11				Uvalde, Tex.	9	45		
Rio Grande City, Tex.	8	45			Verde, (Fort), Ariz.	14			
Rochester, N. Y.			5		Vicksburg, Miss.	7	30		
Rockliffe, Canada.			8		Victoria, Vancouver's I.	23			
Rosebud, Mont.	18	30			Virginia City, Mont.	19	30		
Roseburg, Oreg.	10	30			Visalia, Cal.	16			
Sacramento, Cal.	17				Washington, D. C.			3	
Salt Lake City, Utah.	17				Wickenburg, Ariz.	13	30		
San Antonio, Tex.	9	30			Wilmington, N. C.			0	15
San Diego, Cal.	14	30			Winnemucca, Nev.	18			
Sandusky, Ohio	0	45			Wichita Agency, Ind. T.	11			
Sandy Hook, N. J.			7		Wood's Holl, Mass.			11	
San Francisco, Cal.	16	45			Yankton, Dak.	12	30		
Santa Fé, N. Mex.	13	15			Yates, (Fort), Dak.	15	30		
Santiago de Cuba	3				York Factory, Br. Amer.				
Saugen, Canada.			3		Yreka, Cal.	10			
Savannah, Ga.	2	15			Yuma, Ariz.	13	45		
Shakspeare, N. Mex.	12								

NOTE.—The above table is compiled from Appendix No. 21 to the United States Coast and Geodetic Survey Report, of 1876. Appendix issued 1879.

RAIN-GAUGE.

83. The rain-gauge must be placed, whenever practicable, with the top of the funnel-shaped collector twelve inches above the surface of the ground, firmly fixed in a vertical position, and protected from the interference of unauthorized persons. It must be examined at the time of making each of the three telegraphic observations, the amount of water, including fog or dew, it contains, carefully measured by means of the graduated rod sent with each gauge, and then emptied and returned to its proper position. When a position at the level of the ground cannot be found with a sufficiently clear exposure, the gauge will be placed on the top of the instrument-room, or roof of the building occupied by the observer, who will measure the height above the ground, and report it to this Office. The measuring-rod is graduated in inches and tenths of inches, and the proportion between the cylinder and funnel is as one to ten, so that ten inches upon the rod correspond with one inch of actual

rain-fall, one inch on the rod to one-tenth of rain, and one-tenth on the rod to one one-hundredth of rain. Snow must be melted, and then measured and reported in the same manner as rain, *but the fact of its being melted snow must be noted under the head of remarks in the Original Record and the book of Monthly Meteorological Reports.* Whenever from any cause the snow cannot be melted, the depth will be measured and ten inches of snow reported as one inch of rain-fall. In such cases the fact will be noted in the Journal and Original Record as approximated.

76. Stations in localities subject to heavy rain-fall will be supplied with an attachment to the gauge of sufficient capacity to guard against overflow; but at stations where such rains are exceptional care must be taken by the observer to prevent overflow during heavy rain.

CLOCK.

84. The clock must be hung upon the interior wall of the room occupied as an office, and carefully adjusted to the standard local time of the station.

As it frequently happens that the telegraph time differs from the standard local time, the observer must be careful to note the amount of this difference, in order to avoid confusion in filing his reports. As the time by which the observations are governed must be as nearly correct as practicable, the observer will endeavor to arrange with the manager of the telegraph-office to have both clocks run together as a sure means of preventing errors.

85. The following table shows the difference between local time and Washington time at the signal-stations named. The regular hours for taking observations are 7 a. m., 11 a. m., 3 p. m., 7 p. m. and 11 p. m., Washington time.

For stations west of Washington the figures given in the table for each station must be *subtracted* from the above hours, and the remainder will show the proper local time for the observations.

For stations east of Washington the figures in the table must be *added* to these hours, to obtain the proper local time. Any discrepancies discovered between the figures given here and the local time in use at each station will be promptly reported to this Office.

Station.	Slower than Wash- ington.		Faster than Wash- ington.		Station.	Slower than Wash- ington.		Faster than Wash- ington.	
	Mins.	Secs.	Mins.	Secs.		Mins.	Secs.	Mins.	Secs.
Albany, N. Y.			13	12	Burlington, Vt.			15	2
Alpena, Mich.	26	0			Cairo, Ill.	48	8		
Apache (Fort), Ariz.	131	52			Camp Goodwin, Ariz.	131	0		
Apache Pass, Ariz.	130				Camp Lowell, Ariz.	135	0		
Assiniboine (Ft.), Mont.	130	52			Campo, Cal.	158	0		
Atlanta, Ga.	29	24			Cape Henry, Va.			4	0
Atlantic City, N. J.			11	0	Cape Lookout, N. C.			2	0
Atka, Alaska	388				Cape May, N. J.			8	0
Augusta, Ga.	19	6			Castroville, Tex.	87	0		
Baltimore, Md.			1	36	Cedar Keys, Fla.	24	8		
Bangor, Me.			27	0	Champaign, Ill.	45	0		
Barbadoes, W. Indies.			70	0	Charleston, S. C.	11	6		
Barnegat, N. J.			12	0	Charlotte, N. C.	15	20		
Bélen, N. Mex.	119	0			Charlottetown, P. E. I.			55	0
Bennett (Fort), Dak.	94	32			Chatham, N. Brunswick.			45	0
Benton (Fort), Mont.	134	40			Chattanooga, Tenn.	32	52		
Bismarck, Dak.	94	0			Cheyenne, Wyo.	110	8		
Boston, Mass.			23	6	Chicago, Ill.	42	4		
Bezeman, Mont.	136	4			Chincoteague, Va.			6	40
Brackettville, Tex.	93	0			Cincinnati, Ohio.	30	0		
Brownsville, Tex.	82	0			Cleveland, Ohio.	18	4		
Buffalo, N. Y.	8	0			Clifton, Jamaica.	5	0		
Bufoed (Fort), Dak.	107	48			Coleman City, Tex.	88	40		
Burlington, Iowa.	57	0			Columbus, Ohio.	24	8		

Station.	Slower than Wash- ington.		Faster than Wash- ington.		Station.	Slower than Wash- ington.		Faster than Wash- ington.	
	Mins.	Secs.	Mins.	Secs.		Mins.	Secs.	Mins.	Secs.
Colorado Springs, Colo.	111	52			Lytton, British Col.	177	0		
Concho, Tex.	94	0			McKavett (Fort), Tex.	92	0		
Corrilia Station, Ariz.					Mason (Fort), N. C.			2	
Craig (Fort), N. Mex.	120	0			Madison, Wis.	49	56		
Corsicana, Tex.	79	0			Maricopa, Ariz.	140	0		
Cummings (Ft.), N. Mex.	122	4			Marquette, Mich.	41	1		
Coulson, Mont.	126	0			Mason, Tex.	88	0		
Custer (Fort), Mont.	122	28			Meade (Fort), Dak.	106	0		
Davenport, Iowa.	54	4			Memphis, Tenn.	52	0		
Davis (Fort), Tex.	148	0			Milwaukee, Wis.	43	6		
Dayton, Wash.	163	20			Missoula (Fort), Mont.	148	32		
Deadwood, Dak.	107	0			Mobile, Ala.	44	0		
Decatur, Tex.	82	9			Montgomery, Ala.	37	6		
Deer Lodge, Mont.	143	0			Moorhead, Minn.	79			
Delaware Breakwater, Del.			7	40	Montreal, Canada.			14	0
Denison, Tex.	79	0			Morgan and O'Brien's, Mont.	110	0		
Denver, Colo.	112	4			Morgantown, W. Va.	12	0		
Des Moines, Iowa.	67	0			Mt. Washington, N. H.			22	8
Detroit, Mich.	24	0			Nashville, Tenn.	38	8		
Dodge City, Kans.	93	0			Navassa Island, W. Ind.				
Dubuque, Iowa.	55	0			New Chicago, Mont.	145	0		
Duluth, Minn.	60	4			New Haven, Conn.			16	4
Eagle Pass, Tex.	94	0			New London, Conn.			19	6
Eagle Rock, Idaho.	140	0			New Orleans, La.	52	0		
Eastport, Me.			40	28	Newport, R. I.			23	0
Edinburgh, Tex.	85	0			New River Inlet, N. C.	1	52		
Elliott (Fort), Tex.	94	0			New Westminster, B. C.	183	32		
El Paso, Tex.	118	0			New York, N. Y.			12	0
Ellis (Fort), Mont.	136	4			Norfolk, Va.			3	2
Erie, Pa.	13	0			North Platte, Neb.	95	0		
Escanaba, Mich.	40	4			Ocean City, Md.			7	48
Father Point, Canada.			34	0	Olympia, Wash.	184	0		
Ferry Point, Mont.	112	36			Omaha, Neb.	75	6		
Florence, Ariz.	138	0			Oswego, N. Y.			1	6
Fredericksburg, Tex.	87	0			Ottawa, Canada.			5	0
Gages, Mont.					Parry Sound, Canada.	13	0		
Galveston, Tex.	71	2			Pembroke, Ontario.	0	20		
Garry (Fort), Manitoba.	81	0			Pensacola, Fla.	41			
Grand Haven, Mich.	37	2			Philadelphia, Pa.			7	2
Gibson (Fort), Ind. Ter.	72	0			Phoenix, Ariz.	140	0		
Green's, Mont.					Pike's Peak, Colo.	112	34		
Grant (Fort), Ariz.	131	44			Pilot Point, Tex.	80	0		
Grierson's Springs, Tex.	96	30			Ploche, Nev.	150	0		
Griffin (Fort), Tex.	87	0			Pittsburgh, Pa.	12	0		
Grinnel's, Dak.	103				Pomeroy, Wash.	162	20		
Guadaloupe, W. Indies.			62	0	Port Dover, Canada.	13	0		
Halifax, Nova Scotia.			53	0	Port Huron, Mich.	22	0		
Hatteras, N. C.			6		Port Stanley, Canada.	17	0		
Havana, Cuba.	22	8			Portland, Me.			26	8
Helena, Mont.	140	8			Portland, Oregon.	183	2		
Henrietta, Tex.	85	0			Portsmouth, N. C.			4	0
Hunter's Springs, Mont.	130	20			Powder River, Mont.	113	20		
Huron, Dak.	84				Prescott, Ariz.	144	0		
Indianapolis, Ind.	36	4			Punta Rassa, Fla.	20	0		
Indianola, Tex.	78	0			Quebec, Canada.			24	8
Jacksboro, Tex.	85	0			Radersburg, Mont.	139			
Jacksonville, Fla.	18	0			Rapid City, Mont.	104	0		
Keokuk, Iowa.	58	0			Red Bluff, Cal.	181	0		
Keogh, (Fort), Mont.	115	36			Reno (Fort), Ind. Ter.	84	0		
Key West, Fla.	19	2			Rio Grande City, Tex.	87	0		
Kingston, Canada.			2	0	Rochester, N. Y.	2	8		
Kingston, Jamaica.			1	0	Rockliffe, Canada.	4	0		
Kittyhawk, N. C.			5	0	Rosebud, Mont.	117	52		
Knife River, Dak.	102	8			Roseburg, Oreg.	185	0		
Knoxville, Tenn.	27	6			Sacramento, Cal.	178	0		
La Crosse, Wis.	57	0			Salt Lake City, Utah.	140	0		
La Mesilla, N. Mex.	119	0			San Antonio, Tex.	86	0		
Lapwai (Fort), Idaho.	159	12			San Diego, Cal.	160	8		
Laredo, Tex.	90	0			Sandusky, Ohio.	23	0		
Leavenworth, Kans.	72	0			Sandy Hook, N. J.			12	0
Lewiston, Idaho.	159	56			San Francisco, Cal.	182	0		
Lincoln (Fort), Dak.	95	28			Santa Fé, N. Mex.	116	0		
Little Egg Harbor, N. J.			11		Santiago de Cuba, Cuba.			5	0
Little Missouri, Mont.	109	12			Saugeen, Canada.	18	0		
Little Rock, Ark.	60	48			Savannah, Ga.	16	4		
Live Oak, Tex.	92				Shakespeare, N. Mex.	127			
Logansport, Ind.	37	0			Shaw (Fort), Mont.	139	4		
Los Angeles, Cal.	165	0			Shreveport, La.	66	8		
Louisville, Ky.	35	6			Sill (Fort), Ind. Ter.	86	0		
Lowell (Fort), Ariz.	135	30			Silver City, N. Mex.	125	0		
Lynchburg, Va.	8	0			Sloop Point, N. C.			3	

Station.	Slower than Wash- ington.		Faster than Wash- ington.		Station.	Slower than Wash- ington.		Faster than Wash- ington.	
	Mins.	Secs.	Mins.	Secs.		Mins.	Secs.	Mins.	Secs.
Smithville, N. C.	4	0	.....	.....	Toronto, Canada	9	6	.....	.....
Socorro, N. Mex.	120	0	.....	.....	Tres Alamos, Ariz.	133	0	.....	.....
Spokane Falls, Wash. .	161	0	.....	.....	Trinidad, Colo.	110	0	.....	.....
Springfield, Ill.	51	12	.....	.....	Tucson, Ariz.	136	0	.....	.....
Springfield, Mass. ....	.....	.....	18	0	Umatilla, Oreg.	169	0	.....	.....
Stevenson (Fort), Dak. .	97	28	.....	.....	Unalaska, Alaska.	358	0	.....	.....
Stockton, Tex.	104	0	.....	.....	Uvalde, Texas.	91	0	.....	.....
Stillwater, Mont.	129	24	.....	.....	Verde (Fort), Ariz.	139	32	.....	.....
St. Andrew's, N. B. ....	.....	.....	39	52	Vicksburg, Miss.	56	0	.....	.....
St. George, Bermuda. .	.....	.....	50	.....	Victoria, Vancouver's Is.	186	0	.....	.....
St. John's, Newfoundland	.....	.....	97	0	Visalia, Cal.	169	0	.....	.....
St. Louis, Mo.	53	2	.....	.....	Washington, D. C.	0	0	0	0
St. Michael's (Fort), Alas	336	0	.....	.....	Wickenburg, Ariz.	143	0	.....	.....
St. Paul Minn.	64	4	.....	.....	Wilmington, N. C.	4	0	.....	.....
St. Paul's Island, Alaska.	372	0	.....	.....	Winnemucca, Nev.	163	0	.....	.....
St. Thomas, W. Indies. .	.....	.....	48	0	Wichita Agency, Ind. T.	85	.....	.....	.....
St. Vincent, Minn.	80	0	.....	.....	Wood's Holl, Mass. ....	.....	.....	26	0
Supply, (Fort), Ind. Ter.	90	.....	.....	.....	Yankton, Dak.	82	0	.....	.....
Sydney, C. B. ....	.....	.....	67	0	Yates (Fort), Dak.	94	16	.....	.....
Terry's Landing, Mont. .	122	8	.....	.....	York Factory, B. A.	65	56	.....	.....
Thatcher's Island, Mass. .	.....	.....	25	40	Yuma, Ariz.	150	0	.....	.....
Toledo, Ohio.	26	4	.....	.....			

TOOL-BOX.

86. The following implements for cleaning and repairing instruments are supplied to each station, neatly packed in a small box:

Two screw-drivers, one fitting the screws about the cistern, the other those about the scale of the barometer; a small glass funnel; two porcelain cups, from two to four inches in diameter; kid-skin, for repairing only; shoemaker's thread; white wax; chamois leather; a pair of small forceps; a small three-cornered file, and a blow-pipe.

These articles are furnished for cleaning and repairing station-barometers, and must not be used for any other purpose.

PRINTING-PRESSES.

87. *Press for printing weather-map.*—At stations supplied with a press for printing maps, the following articles, not sent with the press, will be found necessary: A set of type-springs (one for each reporting station), for the rapid justification of the figures; one stick; one galley; sponge; brush; lye; sperm-oil, and benzine.

All these articles will be purchased by the observer, except the type-springs, which will be furnished from this Office. When the Synopsis and Indications are printed (and this should be done wherever there is a press), a font of type will be furnished, in addition to the symbols and figures sent with the press. The Indications should be set in a measure of twenty-eight ems.

88. At stations supplied with type-springs, the figures will not be removed from the plate after each issue, as the work can be done much more rapidly and easily by simply taking out the springs and changing only such figures as are necessary.

The figures and symbols must be removed twice each month, and, with the plate, thoroughly cleaned. The figures can be cleaned daily, in the plate, by using a sponge moistened with benzine. The type used for the Indications must be washed with lye. The ink-roller must be cleaned weekly, or oftener if necessary, and everything pertaining to the press must be kept well cleaned to prevent difficulty.

89. If stations are added for which the bed-plate has not been pierced, observers will have the necessary work done, being careful to get the new stations in their proper geographical positions.

90. One copy of each issue of the map must be kept on file in the observer's office for reference and one copy mailed to this Office.

91. Weather-maps will not be supplied to applicants at any station without direct authority from this Office, to which all applications must be referred. Neither money nor other form of compensation will be charged or received by any observer or assistant observer, or their agents, either for the maps themselves or for their delivery. When maps are authorized for any individual, the necessary sum for prepayment of postage will be furnished from this Office.

92. Observers must keep a careful account of all moneys received by them for this purpose, and make a weekly report of the same to this Office, stating the names of the persons supplied with maps and the amount paid for each during the week.

93. The publication and distribution of weather-maps constitute only a part of the regular daily duty of each observer, and while it is expected a liberal amount of time will be devoted to this work, it must not be done to the prejudice of other duties.

94. For the purpose of systematizing the distribution of maps, observers will divide the territory to be traversed into as many districts as there are assistants on duty at their respective stations. The boundaries of the district assigned to each assistant must be clearly defined, the time required to traverse it ascertained by the observer by actual trial, and the places for the delivery of each map distinctly pointed out to the assistant. Within the limits of these districts, maps will be delivered regularly at the places and to the persons designated by this Office.

95. *Press for printing the Farmers' Bulletin.*—The press used for this purpose will be supplied to each distributing station from this Office.

96. The following articles, required for working the press, when not sent with it, will be purchased by the observer in charge, and a bill for the same forwarded to this Office for settlement:

- | | |
|--------------------------|------------------------------|
| 1. Composition roller. | 8. One composing-stick. |
| 2. One oil-can. | 9. One rule. |
| 3. One mallet. | 10. Ten pounds leads. |
| 4. One shooting-stick. | 11. One lye-brush. |
| 5. One planer. | 12. One saw. |
| 6. Fifty quoins. | 13. One saw-block. |
| 7. Six pieces furniture. | 14. One pound Johnson's ink. |

The standard kind of type used will be pica condensed, of which one 40-pound font, quads and spaces included, will be furnished, together with the following electrotypes for use in printing the Farmers' Bulletin, from this Office:

1. Two official heads.
2. Two official autographs of Chief Signal Officer.
3. Two "Synopsis."
4. Two "Indications."
5. Two "Special bulletins."
6. Two "Farmers' Bulletin."
7. Two "Published by Co-operation."

With proper care, the type should last two years, and the electrotypes one year.

97. *Instructions for printing and distributing the Farmers' Bulletin.*—The Farmers' Bulletin will be printed on flat letter-paper, furnished from this Office, for which timely requisition will be made, so that at least one (1) month's supply may be kept constantly on hand.

The bulletins printed each day at the several stations must be similar in form, size, and appearance to those printed at this Office, and bear the same time and date.

98. The Farmers' Bulletin will be issued every morning, except on Sundays, and one copy of every issue will be mailed to each post-office on the list furnished the observer, and also to this Office, each day. They must be delivered at the post-office of the station where printed in time to be sent off with the earliest morning mail leaving the station. The observer in charge must ascertain from the postmaster of such office the precise hour at which they must be delivered for this purpose, and will instruct his assistants accordingly, by posting up in his own office an order setting forth the time of delivery and name of assistant charged with this duty. He will also ascertain from the postmaster all changes in the schedule of mail routes which affect the time of the delivery of the Farmers' Bulletin at any office in his district, and report them to this office. He will also report the names of all *additional post-offices* that can be reached in time to make the bulletins of benefit, and the names of such offices on his list which cannot be reached in time. In forwarding applications from postmasters or others for the Farmers' Bulletin he must ascertain and indorse on the application the time at which the post-office of the applicant can be reached, before forwarding it to this Office.

99. The assistant charged with the duty of printing the Farmers' Bulletin will report one hour before the usual time of receiving the copy from the telegraph-office, for the purpose of clearing up and distributing the type, cleaning press, and cutting the paper. The average time required for composition will be one hour; and when the form is on press, the sheets must be worked off in time for the mail, the number varying from 500 to 800 per hour.

100. The following cipher will be used in the transmission of the mid-night Indications to the several printing stations. In preparing the Farmers' Bulletin for issue, the name of each district will be substituted for the corresponding number, as indicated below:

Names of districts.

For New England,
For the Middle Atlantic States,
For the South Atlantic States,
For the Eastern Gulf States,
For the Western Gulf States,
For the Ohio Valley and Tennessee,
For the Lower Lake Region,
For the Upper Lake Region,
For the Upper Mississippi Valley,
For the Lower Missouri Valley,
For the Extreme Northwest,
For the North Pacific Region,
For the Middle Pacific Region,
For the South Pacific Coast Region,
For the Pacific Coast Regions,
For the Lake Region,
For the Northern Slope,
For the Middle Slope,
For the Southern Slope,
For the Rio Grande Valley,
For the Northern Plateau,
For the Middle Plateau,
For the Southern Plateau,

Cipher words.

One;
Two;
Three;
Four;
Five;
Six;
Seven;
Eight;
Nine;
Ten;
Eleven;
Twelve;
Thirteen;
Fourteen;
Fifteen;
Sixteen;
Seventeen;
Eighteen;
Nineteen;
Twenty;
Twenty-one;
Twenty-two;
Twenty-three.

An assistant will be at the telegraph-office at least ten minutes before the usual time of receiving the indications from Washington, and will carry them without delay, when received, to the printer. This assistant will remain at the office to fold and mail the bulletins, and will be required to perform his duty promptly and with regularity.

101. The envelopes or wrappers will be addressed, giving name of *post-office, county, and State*, by an assistant selected for the legibility and rapidity of his writing. Especial attention must be paid to legibility, to prevent errors and delays in transmitting these reports through the post-office. Whenever practicable, this duty will be performed by the assistant referred to in the preceding paragraph, and at least one day's supply will be kept on hand properly addressed.

102. Proper arrangements must be made by the observer in charge to supply promptly the place of any one or more of the assistants who may be absent through sickness or other causes, and for this purpose he will instruct his other assistants in the various duties provided for in these instructions.

RAILWAY WEATHER SERVICE.

103. In arranging for Railway Bulletins of Weather Reports, the following points will be observed :

The Chief Signal Officer will cause to be furnished to any railway company entering upon this duty the Indications at a fixed hour; these to be transmitted by the railroad company's operators over their own lines without charge to the United States.

The Bulletins are to be displayed upon bulletin boards, having a heading as follows:

DAILY WEATHER REPORT.

SIGNAL SERVICE, UNITED STATES ARMY.

Published by co-operation of the ——— Railway Company, and posted for the benefit of agriculture, commerce, and the traveling public.

1st. Each station will be supplied by this office with the following articles:

- | | |
|-----------------------|--------------------------------|
| 1 Bulletin board. | Forms 125 B (monthly report). |
| 1 District map. | Forms 126 (Railway Bulletins.) |
| 1 District map frame. | Stamped envelopes. |

2d. Immediately upon the receipt of Indications at the local signal office, a copy of them will be delivered to the general superintendent of the railroad, or person designated by him to receive them, by the observer in charge of station.

3d. The superintendent is to cause the Indications to be at once telegraphed to all night offices of the company, and to all day offices of the company, at as early an hour as practicable, after they are open for business.

4th. A copy of the Indications, plainly written on the "Railway Bulletin," will be posted without delay upon the bulletin board furnished from the Office of the Chief Signal Officer for this purpose.

5th. The time of receiving and time of displaying the Indications will be noted by the station-man on Form 125, which form will be forwarded to the Office of the Chief Signal Officer, by mail, by the operator or manager in charge of the telegraph office at which the Indications are received, at the end of each month for which the report is made, and a retained copy will be kept at the office for reference. Four of the

bulletins displayed at the station will be forwarded by mail to the Office of the Chief Signal Officer, with Form 125, one bulletin for each week included in the report.

6th. A full understanding of, and assent to, these points by the proper authority on the part of the railway company or companies is to be had before the commencement of the Railway Bulletin service thereon.

7th. Observers in charge of stations from which the Indications and weather reports are distributed will give special attention to this portion of their duties. They will see that the reports are furnished to the operator or designated agents of the companies immediately upon their receipt from this Office.

8th. They will confer with the officers of the railway companies at their stations and explain that the object of this service is to distribute the information collected at this Office, and that the reports may prove of value to the railroads, the traveling public, and to citizens on the line of the road.

MANIFOLD WEATHER-MAPS.

164. At stations supplied with manifold weather-maps, the following instructions will be observed :

1st. Count off from ten to fifteen maps from the top of the book.

2d. Place the iron plate under the number counted out, and turn a map down upon it.

3d. Place a sheet of carbon-paper smoothly upon this map, and then turn down the next map, on which put another sheet of carbon, and so on, alternating carbon and maps until the number to be issued is complete, leaving the last map without carbon upon it, taking care to smooth all when done.

In making three or four maps only, a sheet of blotting-paper should be placed next to the iron plate and beneath the lower map.

4th. Place the box of stamps at the top of the map with each die in its proper place, taking especial care not to allow the hands or mallet to rest on the paper, and thus mark and deface the lower maps.

5th. First stamp with symbol-dies the direction of the wind and state of weather as indicated by the legend on the maps. Hold the die perpendicularly to the map, and strike it hard enough to make the impression go through all the maps without cutting the upper one. The actual amount of force required can only be learned by practice.

6th. After the weather use the figure-dies, taking care that the figures for one station do not interfere with those of any other. Stamp the first two figures (thermometer) close together, the next two (barometer, 29 or 30) one-eighth of an inch from the first pair, the last two of the barometer following closely. The last of the figures (velocity of the wind) are to be separated one-eighth of an inch from those for the barometer. Great care must be taken to make the figures neat and regular in appearance, and to stamp them so they can be read without difficulty, and to connect them clearly with the station for which they form the record.

7th. After the maps are properly stamped, write with the stylus in headline the name of station, day of week, date, and time of report, thus: "Washington, D. C., Saturday, April 10, 1880, 7 a. m."

RIVER-GAUGE.

105. No definite form of river-gauge has been adopted by this Office, owing to the difficulty of getting one at a reasonable cost that would be adapted to the essentially different circumstances under which it must

be used at the several river stations. The following description of a simple form of water-gauge will be useful in localities where it is difficult to get one of more scientific construction, and may be used as a temporary substitute for the latter in cases of emergency:

Take a piece of pine scantling, from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in thickness, and from 5 to 6 inches in breadth, the length varying according to the depth of water where it is to be used.

Having planed the scantling smooth, give it a heavy coat of white zinc paint, and after the paint is dry divide the scantling into feet and inches with a rule and lead pencil.

With a small brush paint the inches black, except the center and initial ones of each foot, which will be painted red and in heavier lines than the intermediate ones, thus:



Indicate each foot with its proper number in plain figures marked on the white surface just above the triangle.

Having marked the gauge up to a sufficient height to include the point of maximum high water, select a pile or other stationary object in some portion of the levee or wharf where the gauge will be secure from injury, and where it will not be left dry by the tide or by low water. Lower the gauge into the water, taking care to keep it in a vertical position until it touches the bed of the river or its zero is at the bench-mark or water-level in common use by river men; then firmly secure it to the pile or other object selected by spikes.

If no suitable vertical object can be found to which to fasten the gauge, a gauge will be constructed according to the following directions:

Procure a piece of pine or oak timber, two inches thick by ten inches in width, and of sufficient length to cover the full range of the river between extreme low water and high water marks. This timber will be placed edgewise and firmly bedded in the earth, leaving one and a half inches of its width exposed above the level of the ground. The upper edge will be planed smooth, and carefully graduated in feet and inches, *after being placed in position*, taking the established bench-mark or level previously referred to in this paragraph as the zero of the scale, and numbering the feet and inches, both above and below that point, unless it is at extreme low-water mark, in which case the numbers will all be above the zero of the scale. [Figures 13 and 14.] Especial pains will be taken in graduating the gauge to see that the distances marked off upon it for each foot and its subdivisions will correspond exactly to the *vertical foot* and subdivisions of which they are the measure. This can be readily done by means of an ordinary spirit-level, a straight-edge, on which to place the level, and a graduated rod fixed vertically, from which to take the measurement.

When the gauge is in an exposed place, advantage should be taken of the first low water to secure it from being displaced, by driving in additional spikes, lashing it with strong cords, or otherwise securing it from being washed away. After securing the gauge, fix some point of reference so that in case it should be destroyed another could be put up at the same height. This may be done by marking on some given point in the vicinity any given height of the water. Thus, by driving a spike or drilling a hole and recording the height of the water as read at the time, a "bench-mark," or point of reference, is obtained by which to set up another gauge. A sketch of the place will be made, giving the loca-

tion of the gauge and the point of reference, noting the local names of the surrounding points, so that any other person could find the place from the description.

106. Observers, in publishing their local river reports, will give, in addition to the changes in past twenty-four hours, the height of water above or below the zero of gauge, as the case may be.

FIG. 13.

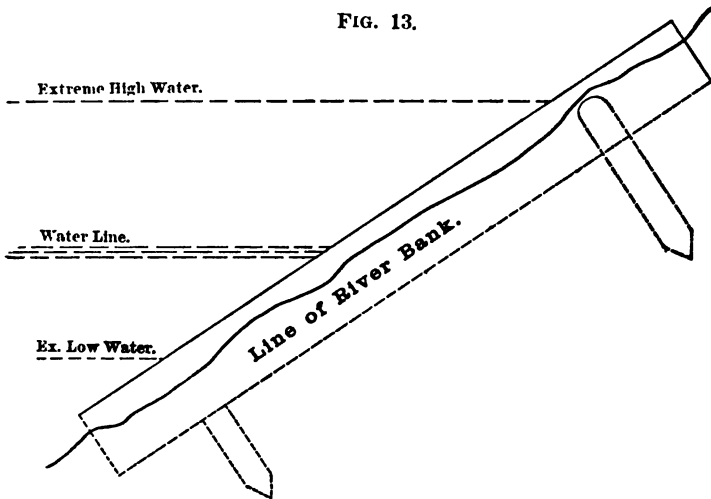
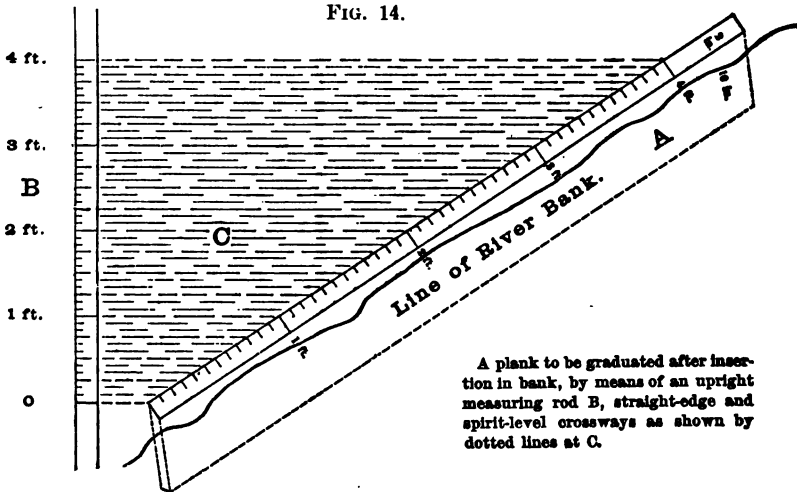


FIG. 14.



107. The river-observations must be made and reported with as much care, regularity, and accuracy as those of the barometer, and where the observer is compelled by pressure of other duties to intrust this part of his work to an assistant, he must assure himself by frequent personal inspection that it is faithfully and honestly done.

Care must be taken, in making observations when the water is rough, to get the mean of the rise and fall of the waves.

CAUTIONARY SIGNALS.

108. The "CAUTIONARY SIGNAL," *i. e.*, a red flag with black square in the center by day, or a red light by night, calls for caution in view of an approaching storm, and is so "CAUTIONARY" WITH REFERENCE TO WINDS BLOWING FROM ANY DIRECTION.

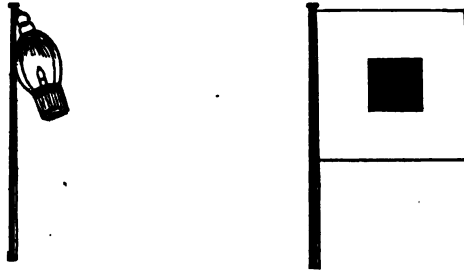


FIG. 15.

THE CAUTIONARY SIGNAL.

CAUTIONARY AGAINST APPROACHING STORM, AND AGAINST WINDS FROM ANY DIRECTION.

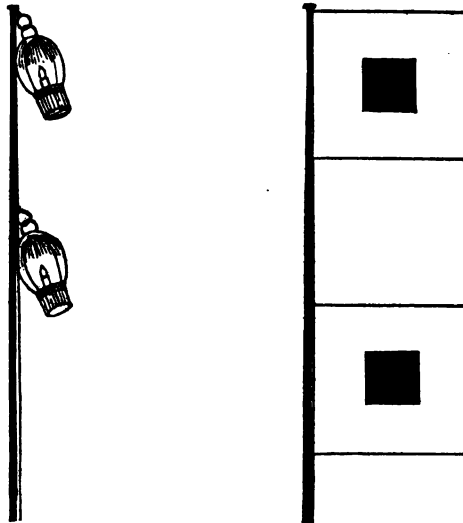


FIG. 16.

THE CAUTIONARY OFF-SHORE SIGNAL AND CAUTIONARY NORTH-WEST SIGNAL.

CAUTIONARY AGAINST ROUGH WEATHER, AND AGAINST WINDS EXPECTED TO BE IN A NORTHERN OR WESTERN DIRECTION, OR "OFF-SHORE."

109. The CAUTIONARY OFF-SHORE SIGNAL, *i. e.*, a white flag with black square in center, shown above a red flag with black square in the center, by day, or a white light shown above a red light by night, is "CAUTIONARY" WITH REFERENCE TO WINDS EXPECTED TO BLOW

FROM A NORTHERN OR WESTERN DIRECTION, OR OFF-SHORE AT OR NEAR THE PLACE AT WHICH IT MAY BE DISPLAYED.

The CAUTIONARY OFF-SHORE SIGNAL will be displayed at and on the regular place and staff, and will consist of a *white flag with a square black center*, shown above a *red flag with a square black center* by day, or a *white light* shown above a *red light* by night. This signal will be known as the "CAUTIONARY OFF-SHORE SIGNAL," and will indicate, when shown, that while the storm disturbance is considered, at the office of the Chief Signal Officer, as not yet passed for the port or place at which the signal is displayed, and the winds may yet be high, and there may be danger, the winds are expected to blow from a northern or western direction, or "off-shore," at or near the port or place where the signal may be.

The display of this signal will often follow, and must be distinguished from the display of the usual "Cautionary Signal," *i. e.*, a square red flag with a square black center by day, or a red light shown at night—which retains, whenever shown alone, its usual meaning. The display of either signal is always cautionary.

110. An additional Cautionary Storm Signal will be displayed, as occasion may require, at all active Signal and Display stations of the Signal Service on the Lakes. This signal will be known as the "CAUTIONARY NORTHWEST SIGNAL," and will indicate, when shown, that at the port or place where displayed it is anticipated that the winds will be dangerous and will blow from the north or west or from a direction between those points. The display of this signal will generally follow, and must be distinguished from the display of the usual "Cautionary Signal," *i. e.*, a red flag with a black square in the center by day, or a red light shown at night, which retains, whenever shown, its usual meaning. *The display of either signal is always cautionary.*

The "CAUTIONARY NORTHWEST SIGNAL," *i. e.*, a white flag with a black square in the center, shown above a red flag with a black square in the center, by day, or a white light shown above a red light, by night, will indicate, when shown, that the storm disturbance is not considered as yet passed for the port or place where it is displayed, and that the winds may yet be high, and the signal is, "CAUTIONARY" WITH REFERENCE TO WINDS EXPECTED TO BLOW FROM THE NORTH OR WEST OR FROM A DIRECTION BETWEEN THOSE POINTS, at or near the place at which it may be displayed.

The order to display signals will be accompanied with a brief message giving the location and probable movement of storm-center, the direction and anticipated changes in the direction and force of the wind in the lake region, and, when practicable, for each lake. The observers in charge of signal stations on the lakes, as well as all displaymen, will bulletin the order to display signals as well as the accompanying message, and any succeeding explanatory message, at such points as will secure the greatest publicity to the shipping interests, and will take any other steps that will insure the greatest distribution to the parties interested in this information.

"Signals Down" lowers any or all signals.

111. Stations ordered to display Cautionary, Cautionary Off-shore, or Cautionary Northwest, Signals will be supplied with two (or more) red flags, one six feet and the other eight feet square, having square *black* centers one-third the size of the flag, and the same number of white flags with black centers; one red and one white signal-lantern; one large flag-staff; and two sets of small staves for use in cases of emergency. The large flag-staff must be from twenty-five to thirty feet or

more in height, and so situated as to be clearly visible to as large a part as possible of the harbor and shipping it is designed to warn of approaching danger. The staff will be provided with halliards for raising and lowering the flags and lanterns, and will usually be erected on the roof of some building, preferably on the one in which the office is located, unless a more desirable position is found near the office.

In displaying two flags, one above the other in a hoist as a signal, a distance of at least two feet more than the length of the upper flag will be kept between the lower edge of that flag and the upper edge of the lower; thus, with four-foot flags the distance will be at least six (6) feet clear between the flags.

In showing two lights as a signal a distance of at least six (6) feet clear will be kept between the upper and the lower light.

If lanterns or lights, shown as signals, swing in such a way as to endanger breaking, the lower light or lantern may be stayed with a small but strong line.

When one signal is to be lowered and another displayed, it may often be convenient to have the new signal already attached to the clear end of the halliards on which the signal displayed is flying, in such a way that as one signal comes down the other signal, complete, will go up.

Everything connected with the signal apparatus must be kept in perfect order; flags mended when torn, ties sewed on, halliards renewed, lanterns kept constantly filled and trimmed, and the approaches to the staff convenient, so that there may be no delay in obeying all orders to hoist or lower signals.

Timely requisition must be made upon this Office for new articles of equipment before those in use become unserviceable.

112. Signals will be ordered up by telegraph from this Office in the words "Up Signals," "Hoist Off-shore Signals," or "Hoist Northwest Signals" and will be ordered down in the words "Signals Down," which lowers any or all signals that may be up. Signals will remain displayed until the order to lower them is received from this Office unless telegraphic communication with the Office is interrupted and continues so for some hours after the storm has passed, in which case the signal will be lowered when the danger is over. Extreme caution must be exercised in this respect not to mistake the customary lull in the center of a storm for an indication that it has passed over the station.

If the Off-shore Signal is displayed and the wind at the time of the receipt of the order "Signal Down" has a velocity of twenty-five (25) miles or more per hour, the signal will be kept displayed and the velocity of the wind will be ascertained from the self-register at least once in each hour. As soon as the velocity has fallen below twenty-five (25) miles in any one hour, the signal will be lowered.

In the written report upon the display will be given the maximum velocity of wind up to the time of the receipt of the order "Signals Down," and also the maximum velocity between that time and the time of lowering the signal.

Sergeants in charge of display stations will order "Signals Down" at sub-stations at the time of lowering their own signals.

Cautionary and Cautionary Northwest Signals will be lowered immediately upon receipt of the order "Signals Down," as heretofore.

The order "Hoist Off shore Signal" or "Northwest Signals" requires that the "Off shore Signal" or "Northwest Signal" be at once displayed, the "Cautionary Signal" being either lowered and the two flags or two lights of the "Off-shore Signal" or "Northwest Signal" hoisted in its place, or the flag or light of the "Cautionary Signal" may be left dis-

played, while the additional proper flag or light needed to complete the "Off-shore Signal" or "Northwest Signal" is shown above it.

113. *Observers must not, under any circumstances, hoist or display Storm Signals without authority from this Office.*

114. The receipt of all signal-orders, either "Up" or "Down," must be immediately acknowledged by telegraph, with the name of station, nature of order, and time of receipt. These acknowledgments will be addressed "Signals, Washington," and signed by the observer or assistant receiving the order. Observers will also report in the same message acknowledging the receipt of "Signals Down," maximum velocity of wind during the display, and the direction of wind at the time of the maximum velocity; state of weather, and temperature of the air, at the time of the receipt of the order "Signals Down." These messages may be very brief. The following examples illustrate the form of message to be used:

SIGNALS, *Washington:*

Chicago—Up Signals received 10.40 a. m.

KAUFMAN, *Sergeant.*

SIGNALS, *Washington:*

Boston—Hoist Off-shore Signals received 7.20 p. m.

PARKER, *Sergeant.*

SIGNALS, *Washington:*

Detroit—Signals Down received 6.30 p. m., justified forty, northeast, cloudy, sixty-four.

SMITH, *Private.*

SIGNALS, *Washington:*

Cape May—Signals Down received 7.30 a. m., not justified twelve, east, cloudy, sixty.

JONES, *Sergeant.*

115. At the end of each week a report on Form 112 will be forwarded in the same envelope with the other weekly reports. This report will be forwarded regularly from all Cautionary stations, whether orders have been received or not.

In acknowledging receipt of "Up Signals" and "Signals Down" for his own station and section (all stations under him) the observer will do so immediately upon receipt from this Office and not await acknowledgments from stations. Observers in charge of sections will report by mail to this Office times of receipt of such orders from this Office, of sending to sub-stations, of receipt by sub-stations, and his receipt of acknowledgment from sub-stations. In case of delay in same, the reasons will be given and an effort made to prevent the same in future.

116. The hours of duty must be so arranged at Cautionary stations that one man will be always in the office, in readiness to receive and obey signal orders.

When observers in charge of sections on the lakes are notified from this Office that Signals have been ordered up or down at stations other than their own, they will notify by telegraph the displaymen of their sections of such order.

DISPLAY STATIONS.

117. Display stations are those designated for the display of Cautionary, Cautionary Off-shore Signals when on the sea-coast, and Cautionary Northwest Signals on the lakes, and are in charge of civilians employed for the purpose. They are usually grouped together in sections, each one of which is under the supervision of the sergeant in charge of a Signal

Service Station near the center of the section, and from whom the several stations will receive their orders, and to whom they will make their acknowledgments of receipt of orders "Up Signals" and "Signals Down" by telegraph.

The display of Cautionary Signals will be ordered by telegraph in the following form from the Signal Service Station :

BOSTON, 5th.

DISPLAYMAN, *Highland Light* :

9.35 a. m., Up Signals. Storm center near Milwaukee.

PARKER, *Sergeant*.

This order will be acknowledged by the displayman (or operator in case of the displayman's absence) as follows :

HIGHLAND LIGHT, 5th.

OBSERVER, *Boston* :

9.50 a. m. Up Signals received.

GRAHAM.

For the display of Cautionary Off-shore Signals the order will be :

BOSTON, 10th.

DISPLAYMAN, *Highland Light* :

7.25 p. m. Hoist Off-shore Signals.

PARKER, *Sergeant*.

This order will be acknowledged by the displayman as follows :

HIGHLAND LIGHT, 10th.

OBSERVER, *Boston* :

7.35 p. m. Hoist Off-shore Signals received.

GRAHAM.

The order "Signals Down" will be acknowledged in the following form :

HIGHLAND LIGHT, 12th.

OBSERVER, *Boston* :

Signals Down received 10 p. m. Justified forty. N. W.

GRAHAM.

HIGHLAND LIGHT, 12th.

OBSERVER, *Boston* :

Signals "Down" received 10 p. m. Not justified ten. E.

GRAHAM.

For the display of "Northwest Signals" the order will be in the same form as for the display of "Off-shore Signals."

118. In acknowledging the receipt of orders, the correct time must be given in all cases.

The displayman will present himself each night at the telegraph office at the time of midnight report, and remain there until the signal "Good Night" is received, and note and report on Form 112 the fact that the office and himself did, or did not, then receive signal orders, giving the time.

As far as possible entries should be made complete, and care taken to record the particulars of each display opposite the proper dates.

When the wind does or does not reach a sufficient velocity to justify a signal, a note to the effect that the signal was or was not justified should be made in the columns headed "Justified" or "Not Justified" on Form 112.

When a storm occurs for which cautionary signals have not been ordered, the entry "No Signals" should be made in the column for remarks, and the provisions of the printed note at the head of that column be complied with.

When a display is not terminated at the conclusion of the week, care should be taken to enter the time of lowering the signal &c., on the form for the ensuing week.

Cautionary signals will be reported as justified when the velocity of wind during display of the cautionary signal reaches twenty-five (25) miles per hour.

119. When there are no instruments at the station for determining the velocity of the wind, its force will be estimated according to the following scale:

SIGNAL-SERVICE SCALE.

0	.....	Calm.
1 to 2	miles per hour.....	Light wind.
3 to 5	" " ".....	Gentle.
6 to 14	" " ".....	Fresh.
15 to 24	" " ".....	Brisk.
25 to 39	" " ".....	High.
40 to 59	" " ".....	Gale.
60 to 79	" " ".....	Storm.
80 miles per hour and above	.....	Hurricane.

It will be recorded on Form 112 in the following manner: No perceptible wind, "calm;" wind blowing with a velocity of from 1 to 2 miles per hour, "light;" wind blowing with a velocity of from 3 to 5 miles per hour, "gentle," &c., &c.

The direction from which the wind is blowing will be designated by the eight principal points of the compass—N., NE., E., SE., S., SW., W., NW.

120. As soon as practicable after a cautionary signal has been lowered at any station the observer (or displayman) will collect from mariners and others data in reference to benefits, &c., derived from its display, the nature and violence of storms and disasters occurring therefrom, and will report the same, together with any comments thereon that may have appeared in the public newspapers, to this Office by letter. The sources from which information is obtained must always be stated. When the signal has not been justified, the fact will be stated. If, however, any storm has occurred in the vicinity of the station during the display, the same will be reported.

121. A lookout will be kept at all sea-coast and lake stations for wrecks during storms, and their occurrence will be reported to this Office, by telegraph, without delay.

In making the report, the following information will be given as accurately as possible: Name and rig of vessel; name of captain; character of vessel (whether passenger or freight); number of passengers; place where vessel is ashore; port from which sailed and port to which bound, and what assistance, if any, is needed. In case assistance is not required, the fact should be stated in the telegram. In case of loss of life, the names of the lost and the names of those saved should be telegraphed to this Office without delay. In making the report care must be had not to confound rumors with facts.

The observer should report only what he *knows* and what he has obtained *from reliable sources*.

Observers or displaymen are authorized to telegraph as frequently as may be necessary to keep this Office advised of all circumstances connected with each wreck.

RECRUITING-FLAG.

122. Each signal service station will be furnished with one United States recruiting-flag for display on special occasions, as ordered from this Office. At cautionary stations it will be displayed on the signal flag-staff, and at other stations a cheap staff, twelve or fifteen feet in length, in the absence of other facilities, may be procured for this purpose, and so arranged that it can be put up and taken down at pleasure.

MAP AND BULLETIN FRAMES.

123. Frames for the proper display of maps and bulletins will be furnished by this Office, and will not be purchased by observers without special authority.

FORMS.

124. The following are the lists of forms furnished by this Office :

PROPERTY.

- Form 1—Invoice of Signal Equipments and Stores transferred.
- Form 2—Vouchers of Signal Equipments and Stores received.
- Form 3—Special Requisition for and Vouchers of Signal Equipments and Stores.
- Form 4—Abstract of Signal Service stores.
- Form 5 A—Certificate of Signal Equipments and Stores expended.
- Form 5 B—Certificate of Signal Equipments and Stores expended (large).
- Form 6—Certificate of Signal Equipments and Stores lost or destroyed.
- Form 7 A—Quarterly return of Signal Equipments and Stores.
- Form 7 B—Quarterly return of Signal Service Property.
- Form 8—Affidavit of Signal Equipments and Stores lost or destroyed.
- Form 9—Receipt voucher for articles purchased.
- Form 10—Receipt voucher for expenditures.
- Form 11—Abstract of articles purchased.
- Form 12—Invoice of Signal Equipments and stores transferred.
- Form 13—Voucher of Signal Equipments and Stores received.
- Form 14—Abstract of Signal Equipments and Stores transferred.
- Form 15—Statement of charges on Muster and Pay Rolls.
- Form 16—Voucher of articles purchased and not paid for.
- Form 17—Abstract of Signal Equipments and Stores received.
- Form 18—Request for Blank Forms.
- Form 19—Letter of transmittal.
- Form 20—Abstract of articles received from various sources.
- Form 21—Abstract of articles expended, lost, destroyed, sold, &c.
- Form 22—Voucher of sales of articles of Public Property at auction.
- Form 23—Special request for authority to make purchases.
- Form 24 A—Memorandum receipt for Signal Service property.
- Form 24 B—Memorandum receipt for Signal Service property (large).
- Form 25 A—Estimate of stationery, forms, &c., required for six months.
- Form 25 B—Estimate of Telegraph Supplies (U. S. Telegraph).

Form 25 C—Estimate of Supplies (quarterly) operator in charge (U. S. Military Telegraph).

Form 26 A—Quarterly Report of Signal Service Property.

Form 26 B—Final Report of Signal Service Property.

Form 27—Account-current (appropriations).

Form 28—Account-current (Line Receipts, U. S. Telegraph).

Form 29—Account-current (Station Receipts, U. S. Telegraph).

Form 30 A—Weekly Statement of Moneys received (U. S. Telegraph).

Form 30 B—Monday Report of Funds, Officer in charge (U. S. Telegraph).

Form 31—Abstract of Purchases (U. S. Telegraph).

Form 32—Abstract of Expenditures (U. S. Telegraph).

Form 33—Abstract of Over-checks (U. S. Telegraph).

Form 34—Error Sheet (U. S. Telegraph).

Form 35—Check Report (U. S. Telegraph).

Form 36—Check Error Sheet (U. S. Telegraph).

Form 37—Abstract of Check Errors (U. S. Telegraph).

Form 38—Check Report of Free Messages (U. S. Telegraph).

Form 39—Report of War Department Messages (U. S. Telegraph).

Form 40—Abstract of Free Messages, War Department (U. S. Telegraph).

Form 41—Report of Department Messages (other than War Department) (U. S. Telegraph).

Form 42—Abstract of Free Messages (other than War Department) (U. S. Telegraph).

Form 43—Statement of Uncollected Messages (U. S. Telegraph).

Form 44—Statement of Guaranteed Messages (U. S. Telegraph).

Form 45—Descriptive list of persons and articles hired on U. S. Telegraph Lines.

Form 46—Invoice of Signal Service Property (Meteorological).

Form 47—Invoice of Signal Service Property (Meteorological large).

Form 48—Final Invoice of Signal Service Property (Meteorological).

Form 49—Requisition for Clothing.

Form 50—Monthly Record of Stamps, &c., received and issued.

Form No. 1 is used in invoicing property transferred from one officer to another in cases where but few articles are transferred.

Form No. 2, to accompany invoices as receipt voucher for property transferred from one officer to another.

Form No. 3, for making requisitions on the Chief Signal Officer for necessary articles of Signal Equipments, &c., for use at military posts. To be approved by the post commander and forwarded through the proper channels.

Form No. 4 (abstract of Signal Service Stores) may be used for abstracts of Signal Service Property received, transferred, purchased, expended, lost, destroyed, &c., every entry on which must be supported by a proper voucher.

Form No. 5 A, to drop from Returns property which has become, through use, completely consumed.

Form No. 5 B, for the same purposes as Form No. 5 A, where the number of items is too numerous to be contained on the other form.

Form No. 6, to drop from Returns property which has been irrecoverably lost or destroyed, and where the responsibility for the loss cannot be fixed, or where the destruction occurred through no carelessness.

Form No. 7 A, for rendering to the Chief Signal Officer a Return, at the end of the quarters ending March 31, June 30, September 30, and

December 31, or part thereof, of all Signal Equipments and Stores for which the person rendering it may be accountable.

Form No. 7 B is a larger form than Form 7 A, to be used for Signal Service Property.

Form No. 8, an affidavit to cover property lost or destroyed.

Form No. 9, Purchases, to show all articles of supplies purchased, the party from whom purchased, the amount paid, and the date on which paid; these vouchers must not be signed "per" or "for," but when made out in the name of an individual, the autograph signature of that person; in the name of a firm, the autograph signature of the firm; and to a corporation, the autograph signature (in his official capacity) of the treasurer or other officer authorized to receipt for moneys due is required, and if signed by mark, such signature must be witnessed.

Form No. 10, Expenditures, to show all services rendered, subscriptions, gas, rent, &c. The same rules as to the signature as in the case of Form No. 9 are likewise applicable to this form.

Form No. 11. (Form No. 4 can be used for this form.)

Form No. 12, for invoicing property, Signal Equipments and Stores (items printed on), transferred from one officer to another.

Form No. 13, to accompany the above form as the receipt of the officer to whom the property is transferred.

Form No. 14. (Form No. 4 can be used for this form.)

Form No. 15, "Statement of Charges on Muster and Pay Rolls," and is used for the purpose of entering up against the pay of an enlisted man the value of any article of government property damaged, lost, or destroyed through neglect or carelessness, or which may have been taken by desertion.

Form No. 16, voucher similar to Form No. 9, except that the former is used where the articles purchased are not paid for until after the expiration of the quarter in which they were purchased. It is a voucher to the Property Return, whereas the Form No. 9 is a voucher to the Money Accounts.

Form No. 17. (Form No. 4 can be used for this form.)

Form No. 18, (old Form No. 20,) a letter form addressed to the Chief Signal Officer requesting yearly supplies of blank forms for official use at a military post.

Form No. 19, (old Form No. 21,) a letter addressed to the Chief Signal Officer, transmitting quarterly property papers pertaining to duty in the Signal Service, U. S. A.

Form No. 20. (Form No. 4 can be used for this form.)

Form No. 21. (Form No. 4 can be used for this form.)

Form No. 22, (old Form No. 41 quartermasters,) "Account of Sales at Auction," and should be prepared at every sale of public property. All money received from sales should be immediately deposited in the nearest United States depository to the credit of the Treasurer of the United States; the original certificate of deposit to be forwarded at once to the Chief Signal Officer with one copy of this form, and the duplicate certificate of deposit to be retained by the officer.

Form No. 23, (letter requesting authority to purchase, &c.,) is used in all cases in making application for purchases or expenditures on station. Whenever the cost of a contemplated purchase exceeds that of the last purchase of a similar kind, explanation as to the cause of the increase must be stated.

Form No. 24 A, (old Form No. 6,) memorandum receipt, and is forwarded from this Office with every issue of property when only a few articles have been issued to the station. Its other and more important

use is that whenever articles of office furniture, fuel, or supplies of any description whatever are purchased by an observer under authority from the Chief Signal Officer, such articles must be entered on a copy of this form as "received by purchase," with the name of the party furnishing it, properly dated and signed, accompanied by the memorandum bill of the same, and then forwarded to the Chief Signal Officer by mail *on the day* on which the purchase was made.

Form No. 24 B, (old Form No. 6, large,) also a memorandum receipt form, and is forwarded with large issues of property such as "yearly" or "half-yearly" supplies. It must be verified, signed, and returned to the Chief Signal Officer without unnecessary delay.

Form No. 25 A, (old form Estimate of Stationery, &c.,) for making requisition for stationery, forms, &c., for extended periods (six months generally). In filling up the several columns care must be taken to give all the data called for in the respective headings.

Form No. 25 B, (old Form No 4,) similar form to the last, but is used exclusively by the officer in charge of a Division on the United States Military Telegraph Lines. It includes all telegraph instruments.

Form No. 25 C, (old Form No. 7, Telegraph, "Requisition and Inventory,") estimate of supplies by the operator in charge of a station on United States Military Telegraph Lines; it must be forwarded so as to reach the officer in charge not later than the first day of the month immediately preceding the quarter for which the supplies are required. The column "To be supplied" is intended for the officer in charge, and must not be filled in by the operator in charge.

Form No. 26 A, (old form "Report of Signal Service Property,") for making out a quarterly report of the property at a station, which report will be rendered at the expiration of the quarters ending respectively March 31, June 30, September 30, and December 31, of each year. This report will be filled out in the following manner: all property received from the Chief Signal Officer, and purchased at the station by proper authority, will be taken up on report as received during the respective months for which invoices are sent; and the aggregate of property received during the quarter (together with that on hand to be accounted for from last report) brought down in the line opposite the words "Total during quarter."

Form No. 26 B, (old form "Final Report of Signal Service Property,") is used whenever an observer is relieved from the charge of a station. He will turn over on proper invoices (Form No. 48) to his successor all property and stores for which he is officially responsible and will take duplicate receipts therefor on this form, one copy of which he will retain and forward the other to this Office; to be made out in precisely the same manner as Form No. 26 A. One copy of the invoice of property so transferred will also be forwarded to this Office by the observer taking charge.

Form No. 27, (old form "Account Current,") is used by officers in accounting for public money, (appropriations.)

Form No. 28, (old Form No. 6 A,) is used by officers in charge of Divisions of United States Military Telegraph Lines in accounting for public money, ("Line Receipts").

Form No. 29, (old Form No. 6,) is used by operators in charge of stations of United States Military Telegraph Lines in accounting for public money, "Line Receipts," to the officer in charge. The instructions printed on this form must be strictly followed.

Form No. 30 A, (old Form No. 22 Telegraph,) for making a weekly

statement of moneys received on account of messages transmitted during the week.

Form No. 30 B, (old form "Monday Report of Funds,") for making report of funds "Line Receipts," on hand, etc., by officers in charge of a Division United States Military Telegraph Lines.

Form No. 31, (old form "Abstract A, Form 19,") abstract of purchases on which are exhibited the Forms No. 9.

Form No. 32, (old form "Abstract B, Form 20,") abstract of expenditures on which are entered the various Forms No. 10.

Form No. 33, (old form "Abstract of Over-Checks,") for settlement of check error sheet to show deficiencies explained and cash paid on account of check errors, upon which the officer takes credit on account-current.

Form No. 34, (old Form No. 5, "Error Sheet,") is used by the officer in charge of Line in adjusting check errors with the operators in charge of stations, reporting discrepancies in their check reports.

Form No. 35, (old Form No. 3, "Check Report,") for the operator in charge in reporting the offices with which he may have check account during the month.

Form No. 36, (old Form No. 10, "Check Error Sheet,") for the operator in charge to show checks made by him against other offices at which differences may have been found to exist.

Form No. 37, (old Form No. 16, "Abstract of Check Errors,") is used by the officer in charge in abstracting errors checked against stations on Line, which are to be accounted for.

Form No. 38, (old Form No. 15, "Check Report of Free Message,") is used in accounting for all free messages sent and received during the month.

Form No. 39, (old Form No. 13, "Report of War Department Messages,") for reporting all messages on official business sent by any officer or agent of the War Department. Such messages are to be transmitted free and checked as *paid over this line*, and the original messages turned in as vouchers to this form.

Form No. 40, (old form "Abstract of Free Business,") is used to show all messages transmitted free from offices on United States Military Telegraph Lines.

Form No. 41, [old Form No. 13 A, Report of (other than War) Department messages,] is used for the same purpose as Form No. 39 for messages on official business sent by any officer or agent of any of the government departments (other than the War Department).

Form No. 42, (old Form No. 14 A, Telegraph,) is used in showing the number of free messages over the United States Military Telegraph Lines for the Executive Departments for a month.

Form No. 43, (old Form No. 11,) is to show any messages sent from or received at any office on the United States Military Telegraph Lines during a month for which the tariff was not collected, with the reasons why it was not collected.

Form No. 44, (old Form No. 12, "Statement of Guaranteed Messages,") to show all messages sent from and received at any office on the United States Military Telegraph Line for which no amount has been collected but the payment of which has been guaranteed.

Form No. 45, (old form "Descriptive List of Persons and Articles Hired,") to show in detail persons, articles, rents, employed and hired, during the month on a Division of the United States Military Telegraph Lines.

Form No. 46, (old form Invoice to Observer, of Meteorological Property,) for invoicing monthly to an observer in charge of station all property issued from this office or purchased by the observer at station during

the month. This form is to enable the observer to properly make up his quarterly report of property (Form No. 26 A).

Form No. 47, (old form Invoice,) is used for the same purpose as above, but is a larger form.

Form No. 48, (old form Final Invoice,) for transferring property from an observer who is relieved to his successor, and accompanies Form No. 26 B.

Form No. 49, Requisition for Clothing.

Form No. 50, Monthly Record of Stamps, &c., received and issued.

METEOROLOGICAL.

Form 101—Original Record of Observations.

Form 102—Anemometer Record Sheet.

Form 103—Anemometer and Anemoscope Record Sheet.

Form 104—Daily Barometer Record Sheet.

Form 105—Semi-monthly Barometer Record Sheet.

Form 106 A—Weather Map (Indication Room, O. C. S. O.).

Form 106 B—Weather Map (printed).

Form 106 C—Weather Map, manifold, for station use.

Form 107—Daily Bulletin, A, B, C, D, &c.

Form 108—Daily River Bulletin.

Form 109 A—Synopsis and Indications (O. C. S. O.).

Form 109 B—Synopsis and Indications (stations).

Form 110—Detailed Synopsis and Indications.

Form 111—Special Bulletin (O. C. S. O.).

Form 112—Weekly Record of Cautionary Signals.

Form 113 A—Monthly Meteorological Report.

Form 113 B—Monthly Meteorological Report, manifold.

Form 114—Monthly River Report.

Form 115—Monthly Report of Water Temperature.

Form 116 A—Monthly Meteorological Data Sheet (7 a. m.).

Form 116 B—Monthly Meteorological Data Sheet (3 p. m.).

Form 116 C—Monthly Meteorological Data Sheet (11 p. m.).

Form 117—Comparative Barometer Readings.

Form 118—Monthly Meteorological Report, second-class stations.

Form 119—Monthly Meteorological Report, third-class stations.

Form 120—Monthly Report of Meteorological Committee.

Form 121—Monthly Meteorological Report of Sunset Stations.

Form 122—Monthly Meteorological Report of Volunteer Observers.

Form 123—Monthly Report of International Simultaneous Meteorological Observations (marine).

Form 124—Monthly Report of International Simultaneous Meteorological Observations (land observers).

Form 125 A—Monthly Report of Weather Bulletins posted by Operators.

Form 125 B—Monthly Report of Weather Bulletins posted by Postmasters.

Form 126—Daily Weather Report Railway Bulletin.

Form 127 A—Annual Meteorological Report.

Form 127 B—Annual Meteorological Report, Complete Data.

Form 128—Annual Meteorological Report, Voluntary Observers.

Form 129—Report of Instruments and their Positions.

Form 130—Weekly River Report (O. C. S. O.).

Form 131—Station Inspection Report.

Form 132 A—Annual Meteorological Summary (pressure, temperature, dew point, humidity, cloudiness, and rainfall).

Form 132 B—Annual Meteorological Summary (winds, weather and miscellaneous data).

Form 133—Weekly Meteorological Record of Cotton-belt Stations.

Form 134—Record of Mean Temperature, Daily and Monthly.

Form 135—Monthly Record of Bulletins, &c., used.

Form 136—Report on Tornadoes.

Form 101, "Original Record", is intended to furnish this Office with data for the correction of errors made at the several stations in reducing and copying the observations. To make it of any value for this purpose, the readings of the different instruments must be entered as made, and *not* copied in from a slip of paper. Observers will habitually carry this book when making an observation, and enter the readings in *pencil*, as noted at the time. They will also use this book for making the proper corrections, as indicated by the marginal references. Pen and ink must *not* be used for entering any observation or correction. The local time of taking the *telegraphic* observations will be entered in the headings.

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Station, ———; Month, ———, 188—.

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BAROMETER.

The observations and corrections for barometer will be recorded as follows:

Attached thermometer :
Observed height.
Correction for temperature.
Barometer : corrected for temperature.
Correction for instrumental error.
Barometer : corrected for instrumental error.
Correction for elevation.
Barometer : corrected.

The barometer will be recorded to thousandths.

WIND.

The *direction* will be recorded to eight points of the compass, (true,) as N., NE., E., &c.

The *velocity* will be recorded as explained under anemometer and electric self-recording attachment.

The *character* of wind will be indicated by the single letter "s" for *steady* or "v" for *variable*, written to the right and above the *direction* and *velocity*; but the cipher words for *steady* and *variable* refer to *velocity*. Absence of wind will be indicated by the figure zero (0) for *direction* and *velocity*.

The *total movement in 24 hours* will be taken from 11 p. m. of preceding to 11 p. m. of current day.

CLOUDS.

Clouds will be recorded on a scale of from zero to ten, zero being clear and ten cloudy.

The following will be recorded as *Upper* clouds: Cirrus, cirro-stratus, cirro-cumulus and cumulus, and abbreviated as follows: Cir., cir.-strat (or cir.-st.), cir.-cu. and cum.

The following will be recorded as *Lower* clouds: Cumulus, stratus, cumulo-stratus, nimbus and fog, and abbreviated as follows: Cum., strat. (or st.), cum.-strat. (or cum.-st.), and nim.; no abbreviation will be used for fog.

Cumulus clouds may be reported either as upper or lower clouds, depending upon the position they occupy.

Haze, smoke, and fog will not be recorded in tenths, but must be invariably designated as Light or Dense, except when they occur in only a portion of the sky or horizon, then as follows: $\frac{1}{10}$ fog in NE., $\frac{2}{10}$ haze in W., &c.

Haze, being a lack of transparency in the atmosphere, has no perceptible movement, and therefore no direction will be recorded. When a movement is observed the particles are something other than haze, as fog, dust, or smoke.

When "Dense fog" is recorded in space for lower clouds, and the weather is reported "Foggy," the word "Hidden" will be written in the space for upper clouds, if the fog is sufficiently dense to obscure the upper clouds; if not, the words "Light fog" will be recorded in the space for lower clouds, and the amount of upper clouds (or the figure zero if there are none,) entered in the spaces for those data.

Absence of clouds will be indicated by the figure zero (0) in the *kind* and *amount* spaces.

When the upper clouds are obscured and the lower are ten-tenths, the word "Hidden" will be written in the spaces for the former.

When more than one kind of upper clouds are observed they will be recorded separately in the column for upper clouds and not in that for lower clouds. In such cases the spaces for kind, amount, and direction of upper clouds will be equally divided for the kinds observed. A similar record will be made in the space for lower clouds when more than one kind of lower clouds are observed.

The *direction* from which the clouds are moving will be recorded to eight points of the compass, as N., NW., W., &c.

The *velocity of clouds* will be indicated by the single letter "s" for slowly and "r" for rapidly, written to the right and above the direction, thus, N^s. W^r, &c. The figure zero (0) will be invariably used to denote absence of movement.

At night when there is any doubt as to the kind, amount or direction of the clouds recorded, a query mark (?) will be placed after the same.

Upon the roof, or wherever the observations of the clouds are usually made, the eight points of the compass (true) will be permanently fixed.

STATE OF WEATHER.

The state of the weather will be determined as follows:

Clear, when the sky is three-tenths or less than three-tenths covered with clouds; *fair*, when the sky is from four-tenths to seven-tenths, (inclusive) covered; *cloudy*, when the sky is more than seven-tenths covered; *sprinkling*, when a few drops of rain are falling (enciphered *light rain*); *light rain*, when light rain is falling; *heavy rain*, when heavy rain is falling; *sleeting*, when sleet is falling; *light snow*, when light snow is falling; *heavy snow*, when heavy snow is falling; *threatening*, when the clouds indicate approaching rain or snow; *clearing up*, when the clouds indicate clearing weather after rain or snow; *thunder-storm with light or heavy rain*, when a thunder-storm is prevailing at the moment of the observation, or the rain is still falling, although neither thunder has been heard nor lightning observed for some time previous to the observation. *Foggy, smoky, or hazy*, when either prevails to such an extent as to obscure the sky; in other cases the record in the cloud spaces will show the extent of either prevailing, and the weather will be recorded as "clear," "fair," or "cloudy," according to the amount of cloudiness.

When precipitation begins and ends after the last observation for the day has been taken, the time of such beginning and ending will be entered under the head of the first observation of the subsequent day.

Precipitation which is too small to measure will be noted in the proper space by a dash (—), and the word "Inappreciable" written on the margin of the page, the person taking the observation always being careful to connect the dash (—) and the word by an asterisk (*).

Absence of precipitation will be indicated by the figure zero (0).

The occurrence of *first* "frost" at station will be noted in this book.

under its proper date and time, and reported to this Office by telegraph in the prescribed manner.

Whenever, from any cause, an observation is not taken, or is taken late, the reason therefor must be plainly written in all records and on all forms affected thereby, in the space which such observation would have occupied had it been taken.

If an observation is taken fifteen minutes or more late, it will be recorded with the *exact* time at which it was taken, but it will not be used in the computation of any of the means of the station; which fact must be clearly set forth by a remark in connection with such observation wherever recorded.

In case an instrument becomes unserviceable the word "Blank" will be written in the spaces for its readings, and an explanatory note made in connection therewith. When the anemometer is out of order, or when there is no anemometer at a station, the wind force will be expressed in the Original Record, and on all forms, by "calm," "light," "gentle," "fresh," &c.

The name of the person taking observations must be signed in the spaces for that purpose at the bottom of the page, and to each observation.

Changes of the barometer since preceding observations will not be noted in this book.

The time of the beginning and ending of precipitation must be recorded when the interval between showers equals or exceeds fifteen (15) minutes.

Under no circumstances are observers allowed to make *erasures* or *alterations* in any observation recorded in the Original Record of Observations, nor is it proper to write one figure over another after it has been recorded. If an error has been made, the correct reading will be noted on the margin of the page, in connection with an explanatory note in reference thereto.

The book will be forwarded to this office not later than the 10th of the month succeeding that of which it is the record. From stations at some distance from railroads, especially in the Territories, whence mail-matter is liable to be lost in transit to this office, it will be *registered*.

Form 102. Anemometer Record Sheet.

Form 103. Anemometer and Anemoscope Record Sheet.

The manner in which these sheets should be placed upon the register, prepared for mailing, &c., has already been described.

Form 104. Daily Barometer Record Sheet.

Form 105. Semi-monthly Barometer Record Sheet.

Form 106 A, Weather Map, Indication Room, O. C. S. O., will be issued when directed from this Office, and shows the direction of the wind, state of weather, height of barometer, height of thermometer, dew-point and velocity of wind at each station. The arrow is always to fly *with* the wind, and *not toward* it, like a vane. In printing or stamping these maps great care must be exercised to make the figures and different signs correctly and legibly. Observers must never allow imperfect or illegible maps to leave their offices. To insure accuracy the printed maps, before issue, must be carefully compared with the original reports, and all errors corrected. If in the manifold issue they cannot be corrected without disfiguring the map and rendering it illegible, the whole edition will be destroyed, as it is better not to issue any map than one which is incorrect.

One copy of the manifold map will be sent to this Office on Saturday of each week, unless special instructions are received to the contrary.

Observers are authorized to trace upon these maps *isobars*, or lines of equal barometric pressure, in accordance with the following directions:

Ascertain by a general examination of the reports after they have been entered on the map whether any of the lines of equal pressure will, when drawn, traverse a large portion of the map, and if this is found to be the case these long lines will be drawn first. The lines 29.90, 30.00, and 30.10, on the map, opposite page 12 of the circular issued by this Office on the practical use of meteorological reports and weather-maps, are illustrations of this principal isobar or *base-line*.

If decided differences in barometric readings are observed to exist between neighboring stations, enter upon the map with a red-lead pencil little dots or dashes, intermediate between any two of them, to represent the points at which the barometric reading would be exactly 29.50, 29.60, &c., or 30.00, 30.10, &c., supposing the pressure to change uniformly in the space between the two stations. The precise position of these intermediate points can usually be found with sufficient exactness by estimation with the eye.

The interpolated isobars—those which are drawn between stations, as in the preceding paragraph—cannot be relied upon as perfectly accurate, but the amount of error need not exceed two-hundredths of an inch in the position of any line, if proper attention is paid to the following points:

1st. The isobars must not be extended west of the one-hundredth degree of longitude west of Greenwich (or the meridian twenty-three degrees west of Washington), as the barometric readings of very elevated stations cannot at present be combined with those of an altitude of two thousand feet or less.

2nd. The barometrical readings reported from Mount Washington must not be used in drawing the isobars over the New England States.

3rd. Certain allowances or corrections must be made for the readings reported from several stations whose elevation is not yet accurately determined. These corrections will be furnished from this Office upon application.

When a sufficient number of dots or dashes have been made to enable the observer to trace the course of one or two of the principal isobars, they will be joined together by a curved line passing through, or nearly through, all of them, without following any of the minor irregularities that would be possibly caused by slight errors in the interpolations.

Any perplexity that may arise in drawing these lines, as to their proper route, may generally be removed by considering the direction of the wind, as reported from each station. Thus, if from stations A, B, C, and D (Fig. 17), reports are received as shown in the figure, it would be seen at once that between B and C there was a central area of low pressure, around which the wind circulated in the direction indicated by the arrows, and the isobars would therefore be drawn as shown by the dotted lines.

When the lines are very much crowded together, as happens in a few severe storms, the isobars may be drawn for every two-tenths of an inch, instead of every one-tenth.

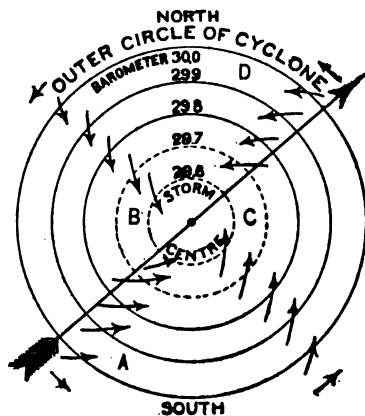


Fig. 17.

Each isobar should be plainly marked at its extremities with the figures indicating the corresponding pressure, and the central areas of highest and lowest pressure should be marked "High" and "Low," respectively, unless by so doing the appearance of the map would be injured by the complication of the lines.

When the observer has any doubt as to the course of a given isobar, he should omit it entirely or simply indicate its probable position by a broken instead of a full red line. Observers will forward to this Office weekly samples of their isobaric maps, and will not post them in any public place until officially authorized to do so.

Form 106 B, Weather Map. This is the green weather map printed at this office.

Form 106 C (old Form 8), manifold map for Station use.

Form 107 A, B, C, &c., (old Form 3 A, B, C, &c.) is the daily manifold bulletin issued for public information. The several columns will be filled up from the receiving-sheet, the words and figures being written plainly and distinctly.

Before making any entries upon the manifold form the sheets will be carefully smoothed down, so that the registered lines of the several stations will fall directly over each other. If more than fifteen bulletins are to be written, it is better to make out the number in two equal parts than to try and write them all at once, in order that all the copies may be legible.

The headings of the different columns indicate with sufficient clearness the matter to be filled in.

When any part of a report is not received, or, if received, is evidently incorrect, the word "Blank" will be written in the spaces to be filled by such part.

Absence of wind, rainfall, or change in barometer, thermometer, and river will be indicated by the figure zero.

New stations, whose names are not in the printed list, will be written in the blank lines at the bottom of the form or over the names of stations from which reports are not received.

Each copy of Form 107 posted must show the name of place where posted, date and time of posting, and be signed by the observer or assistant making it out.

A file copy of Form 107 for each issue will be preserved for office-reference, and suitable covers for protecting these retained copies from defacement and other injury will be furnished from this Office on application. One copy of the morning issue of the Saturday bulletin, on which the name of station from which sent must be plainly written, will be mailed to this Office with the other weekly forms.

At stations supplied with the hektogram, white paper bulletins must be used, which will be furnished upon requisition. Care must be taken in writing the hektogram bulletin to enter the data upon it in a neat and legible manner.

Form 108, (old Form 26,) is the River Bulletin, and will be filled up as indicated by the several headings, and posted in such places as are found necessary to give suitable publicity to the reports and meet the wants of business men interested in them. The name and location of each place of display must be reported to this Office. A copy must be supplied regularly to each daily newspaper published at the station, and one copy will be forwarded to this Office on Saturday of each week.

Form 109 A is used only at this Office.

Form 109 B (old Form 15) is for the synopsis and indications, a copy of which, properly filled up, will be posted with each bulletin at all

stations where they are received, and at which the Farmers' Bulletins are not printed. The midnight indications will be used with the morning bulletin, and the morning indications with the afternoon bulletin, whenever practicable. At stations where the afternoon, and not the midnight, indications are received, they will be used with the bulletin of the next morning. Blank manifold paper in books, and printed headings for same, are furnished.

In all cases the time and date of issue from Washington must be plainly written upon the form.

Form 110, ("Detailed Synopsis and Indications,") is used only at this Office by officers under instruction.

Form 111, ("Special Bulletin,") is used in posting special messages. Whenever a message is received from this Office, in regard to wrecks or storms, copies of the same will be made on this form and posted in all bulletin frames that are displayed in public places.

This form will also be used in bulletining the special indications telegraphed from this Office.

Form 112, (old Form 23, Weekly Record of Cautionary Signals,) is for use at stations designated for the display of Cautionary Signals, and will be filled up and forwarded weekly to this Office.

Care must be taken by the observer to accurately record the time of commencing, time when at its height, and time of ending of each gale, with prevailing direction and highest velocity of wind during the storm, and the direction of the wind at the time of the highest velocity of every storm which passes over his station, whether Cautionary Signals were ordered for it or not.

A display of signals will not be reported as justified unless the wind attains a velocity of twenty-five (25) miles per hour.

A signal must never be reported *partly* justified, but, should the wind in the vicinity of a station be sufficiently great to justify a display of the signal, while at the station it should not reach the storm velocity, the signal should be reported as not justified, and the facts in the case be noted in the column for Remarks, giving the character of sea, nature and extent of disasters, and any other data which would enable this Office to arrive at a proper conclusion in the case.

The Off-shore and the Northwest Signal will be reported justified as to velocity when the velocity of wind during the display of that signal reaches twenty five (25) miles, but not justified as to direction when the direction of wind is not off-shore or from the N. or W. or from directions between those points, and fully justified when the velocity reaches twenty-five (25) miles per hour and the direction of wind is off-shore or from the N. to W.

If an order to hoist signal is received after a gale has already set in, it will be noted as justified, but a note must be made in connection therewith to the effect that the order was received late, and the cause of its late receipt given, where it is known to the observer. If, however, a storm should end before an order to hoist a signal has been received, it will be recorded as a storm for which no signal was ordered, and the display of signals as not justified.

In the column of "Remarks" will be noted such special cases of benefits to commercial or other interests as may come to the observer's knowledge. It will also be stated whether any storm passed over the station during the week for which the Cautionary Signals were not ordered.

All casualties resulting from storms at any cautionary station will be reported so far as they come within the knowledge of the observer. In

giving information, newspaper clippings may be used and forwarded with Form 112, fastened upon a separate sheet of paper in such manner that they can be easily detached for pasting in the office scrap-books.

All notes on this form referring to Cautionary Signals must be entered in black ink; all notes referring to Off-shore or to Northwest Signals, in red ink.

Form 113 A, (a combination of old Forms 4, 22, 28, and 32,) is the Monthly Meteorological Report, one copy of which will be forwarded to this Office at the end of each month.

In filling up this form, the *daily* and *monthly* means will be computed from the 7 a. m., 3 p. m., and 11 p. m. observations, and will be entered in their proper columns.

In calculating the mean of thermometer-readings at low temperatures, the following rule will be observed:

"When minus-readings occur, the difference between the sum of the positive and the sum of the negative numbers is to be taken. This difference, which is the *total sum*, has the sign of the greater of the two partial sums, and will be divided by the *total* number of observations."

The quotient obtained by this division will be the mean sought.

The following are examples:

EXAMPLE 1.

	+	5
	+	13
	-	2
	-	2
<hr/>		
Sum of positive	+	18
Sum of negative	-	4
<hr/>		
Total sum	+	14
Number of observations		4
Mean	+	3.5

EXAMPLE 2.

		0
	+	9
	-	1
	-	1
<hr/>		
Sum of positive	+	9
Sum of negative	-	2
<hr/>		
Total sum	+	7
Number of observations		4
Mean	+	1.8

EXAMPLE 3.

	+	2
	-	5
		0
	+	4
	-	7
	+	5
	-	15
<hr/>		
Sum of positive	+	11
Sum of negative	-	27
<hr/>		
Total sum	-	16
Number of observations		7
Mean	-	2.3

EXAMPLE 4.

		5
		0
		0
		0
		0
		0
		0
<hr/>		
Sum of positive		0
Sum of negative	-	5
<hr/>		
Total sum	-	5
Number of observations		7
Mean	-	0.7

In computing the daily means of pressure, temperature, humidity, and dew point the sum of the 7 a. m., 3 p. m., and 11 p. m. (Washington time) observations will be divided by three. In computing the means of the barometer the figure in the fourth decimal place will always be dropped, but if it is greater than 5 the third figure will be increased by one; if it is 5, the third figure, when an odd number, will be increased by one, and when an even number it will not be increased; if the figure to be omitted is less than 5, retain the preceding figure unchanged.

The same rule applies to the means of temperature, relative humidity, and dew point, but the division is *to be carried to two decimal places*, and one decimal only recorded.

Absence of wind, clouds, and rainfall will be indicated by the figure zero.

When the upper clouds are obscured, the word "Hidden" will be written in the proper columns.

When the amount of precipitation which has been collected in the gauge is too small to measure, the fact will be indicated by a dash (—) in the column headed "Amount of rain or melted snow," and the word "Inappreciable" written under the head of Remarks, and the dash and word connected by an asterisk (*) or other reference mark.

All times of beginning and ending of precipitation must be recorded when the interval between showers equals or exceeds fifteen minutes. The character of rain, snow, &c., must be designated as "Light" or "Heavy," as the case may be.

When precipitation begins or ends after the last observation for the day has been taken, the time of beginning or ending should be recorded under the head of the first observation of the following day.

If an observation has been missed, or has been taken late, the cause thereof must be properly explained by an appropriate note in the column for "Remarks," and on all forms and in all records in which such observation is recorded.

In case an instrument becomes unserviceable, the word "Blank" will be written in the spaces for its readings, until it is repaired or replaced, except wind direction and force, and an explanatory note made in connection therewith.

When more than one kind of upper or lower clouds are observed, the amount and direction of *each kind* must be separately given, and in the column designated for each. The occurrence of first frost will be noted under the head of "Remarks."

In deciding whether a day is clear, fair, or cloudy, its character will be determined by taking the sum of the entire number of tenths of clouds observed at 7 a. m., 3 p. m., and 11 p. m., Washington time. A clear day will be one in which the sum of the observed tenths is from 0 to 8 inclusive; a fair day, one in which the sum is from 9 to 22 inclusive; and a cloudy day, one in which the sum is from 23 to 30, inclusive.

The *total movement* of wind during the month will be the number of miles counted from 11 p. m., Washington time, of the last day of one month to 11 p. m., Washington time, of the last day of the succeeding month. The *maximum* velocity of wind for each day will be calculated from the record sheet from 11 p. m. to 11 p. m., Washington time, as explained for computing other velocities. The direction of the wind at the time of maximum velocity will be recorded.

In filling up that portion of the form prepared for rain-wind data, the following rules will be observed. In the

First column, record day of month and year.

Second column, record rain, snow, hail, or sleet.

Third column, record actual time of commencement (hour of day), and in case it commences before the ending of the preceding month, the date also.

Fourth column, record actual time of ending (hour of day).

Fifth column, record direction from which wind was blowing at each observation during continuance of precipitation.

Sixth column, record direction from which wind was blowing at each of the three (3) observations immediately *preceding* the commencement of precipitation.

Seventh column, record direction from which wind was blowing at

each of the three (3) observations immediately *following* the ending of precipitation.

The wind directions recorded in columns 5, 6, and 7 must follow each other in the order in which the observations are taken.

When precipitation begins and ends between observations, the words "No observation" will be written in the column headed "Direction of wind during rain or snow."

When an interval of five hours occurs between the ending of precipitation and its recommencement, separate storms should be recorded.

Storms in which the amount of precipitation is too small to measure, should not be considered. The following is an example of the proper method of recording these data:

Date. 1880.	Rain, snow, hail or sleet.	Time of commence- ment.	Time of ending.	Direction of wind during rain, snow, hail or sleet at each observation.	Direction of wind at three (3) ob- servations pre- ceding rain, snow, hail or sleet.	Direction of wind at three (3) obser- vations following rain, snow, hail or sleet.
Dec. 1st.	Rain.	8 a. m.	9.25 a. m.	No observation.	0. 0. N.	S. S. S.
" 3d.	"	4.50 p. m.		NW. and S.	SW. S. S.	
" 4th.	"		1.30 a. m.			N. N. N.
" 6th.	"	6 a. m.	11 a. m.	W. W.	W. S. S.	N. N. NW.
" 13th.	"	8.40 p. m.	11.30 p. m.	S. and W.	S. S. S.	S. S. NW.
" 16th.	"	9.40 p. m.	11.45 p. m.	S.	S. S. S.	SW. SW. NW.
" 20th.	"	6.40 a. m.	8 p. m.	NE. NE. NE.	NE. NE. NE.	NW. NW. N.
" 22d.	"	2.06 p. m.	4 p. m.	No observation.	S. S. S.	S. S. SW.
" 26th.	"	11.50 a. m.	11.10 p. m.	S. S. S. S. W.	S. S. NE.	N. N. W.
" 28th.	"	7.30 p. m.		W. SW. S. 0.	S. SW. S.	
" 29th.	"		9.30 a. m.			NW. NW. NW.

Special attention must be given to Form 113 A, and the several columns will be added up *twice*, both by the observer and assistant, in order to secure accurate results. Synopses of this form will, at the end of each month, be furnished by observers to as many of the newspapers and other periodicals published at their stations as may desire to make use of it. One copy will also be forwarded to this Office on the *first* day of the month succeeding that of which it forms the record. Manifold books of this form (113 B) will be furnished to those stations at which a large monthly issue is found necessary.

Bound volumes of these forms (113 A,) each of sufficient size to last for a period of five years, will be supplied stations. These volumes will be filled up in the same manner as the forms and will be preserved with care. The constant used in reducing the barometer readings to sea-level will be entered on the last page of the form immediately after the altitude of station.

Form 114, (old Form 28,) is for use at *special* river-stations, and will be forwarded monthly to this Office, properly filled up, as indicated by the several headings. Under the head of "Remarks" on this form will be noted all unusual occurrences connected with the stage of water in the river at and near the station, such as the presence of floating ice, timber, &c.; formation and breaking of ice gorges and other obstructions; damages to levees; time of opening and closing of navigation; accidents to gauge, or change in location of same, &c. This form will also be used at such stations as are required to duplicate or triplicate their reports for special purposes.

Form 115, (old Form 32,) is the monthly report of observations of the temperature of water, of which *one* copy will be forwarded to this Office on the first day of the month succeeding that of which it forms the

record. The precise nature of the spot where the water-temperatures are taken must be noted under the head of "Remarks."

Forms 116, A, B, C, &c., are planks which will be furnished stations and which will be kept filled up with the data called for by the headings of the several columns and promptly forwarded to this Office at the expiration of the month for which they are the record.

Form 117, (old Form 33,) is the one on which the monthly comparative barometric readings are recorded, and must be forwarded from all stations with the monthly abstract of journal. Where there is but one barometer on station, or where the duplicate is unserviceable, the fact must be noted under the head of "Remarks."

Form 118 is the Monthly Meteorological Report used at second-class stations.

Form 119 is the Monthly Meteorological Report used at third-class stations.

Form 120 is the monthly report of the Meteorological Committee of Board of Trade, Chamber of Commerce, &c.

Form 121 is the Monthly Meteorological Report from sunset stations, (old Forms X and Y combined), and will be filled up with the data called for by the headings of the several columns and promptly forwarded to this Office at the expiration of the month.

Form 122, (old form H,) is the Monthly Meteorological Report from voluntary observers of the Signal Service, and contains full instructions in regard to the manner of taking observations, recording data, &c. Voluntary observers will continue to take meteorological observations at the respective hours of 7 a. m., 2 p. m., and 9 p. m., local time, and the mean daily temperature will be computed as explained on the form.

Forms 123 (Marine) and 124 (Land) are used for recording simultaneous international observations, taken at 7 a. m., Washington mean time, and published in the Bulletin of International Observations. Full instructions in regard to the manner of preparing these forms are printed upon them.

Forms 125 A and B, (old Form 29,) is the Monthly Report of Weather Bulletins which are posted daily by railway operators and postmasters. This form contains a record of the time of receipt of the Farmers' Bulletins at post-offices, and Railway Bulletins at stations on the lines of roads co-operating with the Service in the distribution of weather reports. It is forwarded to this Office for examination at the close of each month.

Form 126 is the Daily Weather Report (Railway Bulletin) upon which are written the midnight indications furnished from this Office.

Form 127 A, (old Form 34,) is for the Annual Mean, or Meteorological Summary, which must be posted in a conspicuous place in the observer's office. On this form will be entered, on the first day of each month, the data for the preceding month, as indicated at the top of the several columns. A carefully compared copy of this form must be forwarded to this Office within fifteen days after the close of the year of which it forms the record, the original being kept for station reference. Frames for the display of this form will be supplied on requisition.

Form 127 B is for the Annual Meteorological Report, complete data, and to be forwarded to this Office.

Form 128 is the Annual Meteorological Summary, furnished by voluntary observers, and contains in a condensed form the data found on the monthly Form 122.

Form 129 is the Report of Instruments and their Positions, one copy, of which, when made out, is to be forwarded to this Office and the other retained for office file. In obtaining data for entry upon this form great

care must be exercised to have them reliable and accurate. A complete explanation of the data given on this form will be given step by step. Points from which measurements are made will be accurately described so that they may be readily found, and the authority for all measurements will be stated on the blank.

Form 130 is the Weekly River Report used only in the Indications Room of this Office. Upon this form are entered the daily telegraphic river reports, for use in preparing Indications, Special River Bulletins, &c.

Form 131 is the Station Inspection Report, and is used only by Inspecting Officers in making report of stations inspected, and contains full directions as to the manner in which such reports should be made.

Forms 132 A and B are the Annual Meteorological Summaries, and contain a summary of the pressure, temperature, humidity, dew-point, cloudiness, precipitation, wind, and character of weather. These forms will be furnished to each station, and will be filled up from month to month, as indicated by the headings of the several columns, and mailed to this Office not later than the 10th day of July of each year.

Form 133 is the Weekly Meteorological Record of Cotton Belt Stations, located on railroads co-operating with the Signal Service for the benefit of the cotton interests. This form is bound in books of about 200 each, and is in duplicate. The original is detached and mailed to this Office weekly, while the duplicate remains in the bound book and is retained as the station record.

Form 134 is the Record of Daily Mean Temperature at the several stations for each year since establishment, and will be made out at each station as follows, viz:

1. The columns in table 7 of daily means are to be filled up by computing from old Forms 4, telegraphic, the mean temperature of each day, by the rule one-third of the temperature observed at 7.35 or 7 a. m., 4.35 or 3 p. m., and 11.35 or 11 p. m., Washington time, so that the daily means for each date of any one month (from January 1st to December 31st), since the existence of the Signal Service Station, will appear on this sheet.

2. The computation will begin with the month of August, 1870, to 1881, the monthly sheet for which will be forwarded to this Office during the month following the receipt of this form. The month of September will then be taken up and its table reported during the next month, and so on until the twelve calendar months have been reported, ending with December, 1881.

3. The table of monthly means for each of the hours of simultaneous observations will also be filled up, and the figures in the two tables must check and agree with each other and with the figures given on Form 113.

4. When one or more simultaneous observations are missing, count the whole of that day as blank, both in computing the daily and monthly means, but in a note give a record of the observations that were made.

5. In a special note give the dates at which the observations were changed, and also state whether the simultaneous observations have at any time been made at other than the correct moment.

6. Give, when practicable, the changes that have been made in the thermometers used and the corrections to the thermometers, as shown by the tests or comparisons.

Form 135 is the Monthly Record of Bulletins, Maps, Press Reports, &c., used.

Form 136 is used to make a detailed report of tornadoes occurring in the vicinity of a station.

TELEGRAPHIC FORMS.

- Form 201—Telegrams Sent.
- Form 202—Telegrams Received.
- Form 203—Cipher Telegraphic Report.
- Form 204—Receiving Sheet for Cipher Reports.
- Form 205—Operators Wire Report.
- Form 206—"Up Signal" Order.
- Form 207—"Hoist Off-shore Signal" Order.
- Form 208—"Hoist Northwest Signal" Order.
- Form 209—"Signals Down" Order.
- Form 210—Cautionary Signal Order Sheet (O. C. S. O).
- Form 211—Weekly Abstract of messages sent and received.
- Form 212—Weekly Line Report "A," "B," "C," &c.
- Form 213—Repairman's Weekly Trip Report (sea coast line).
- Form 214—Repairman's Trip Report (U. S. Telegraph).
- Form 215—Working Form of Circuit.
- Form 216—Monthly Report of Press Received (U. S. Telegraph)
- Form 217—Monthly Return of Detachment (U. S. Telegraph).
- Form 218—Monthly Labor and Material Report (U. S. Telegraph).
- Form 219—Report of Pilot Boats (Delaware Breakwater).
- Form 220—Report of Tugs (Delaware Breakwater).
- Form 221—Daily Record of Vessels (Delaware Breakwater).
- Form 222—Skeleton Message Blank (O. C. S. O).
- Form 223—Notification of Signal Orders (O. C. S. O).

TELEGRAPHY.

Form 201—Telegrams sent (old Form 2 U. S. Tel. and 25): All official telegrams sent from stations (except cipher weather reports) must be written on Forms 201 and signed by surname of observer or assistant.

Telegrams sent to this Office must be addressed simply, "Signals, Washington," and all unnecessary words omitted from the body of the message in order to save expense to the government.

Observers or assistants on stations sending weather reports by special message to this Office will not sign their name to be transmitted by telegraph.

The name of place sent from, date, time filed, and, when practicable, the time sent, and the check "paid" or "collect government rate," must be written on all official telegrams filed for transmission, and an exact duplicate of message retained by observer to be mailed to this Office weekly with Form 211.

Form 202 (old Form 1) will be used for receiving all official telegrams. The originals of all received messages, at any Signal Service Station, will be forwarded to this Office weekly with Form 211.

Form 203 (old Form 5) will be used for all regular telegraphic reports, and will be made out each time in duplicate, one copy for file in the telegraph office for transmission by telegraph, and the other for transmission by mail to this Office.

In making the duplicates of this form carbon-paper and a hard lead pencil will be used, and *both* copies written at the same time.

The time of filing in the telegraph office and the transmission of the reports must be filled in by the telegraph operator who receives and transmits them and verified by his signature.

Especial care must be taken, in filling up this form, to write the cipher words clearly and distinctly.

Corrections must not be made on the retained copies of Form 203 after the reports have been transmitted by telegraph.

In filling up Form 203, the Barometer word (for the barometer readings reduced to sea-level) for all *morning* reports will begin with the letter M.

The Barometer word (for the barometer readings reduced to sea-level) for all *evening* reports will begin with the letter E.

The Barometer word (for the barometer readings reduced to sea-level) for all *midnight* reports will begin with the letter N.

In case the barometer is not reduced to sea-level, or it is out of order, the cipher date words, beginning respectively with the letters "C," "G," and "N," will be used, instead of the Barometer words, beginning with "M," "E," and "N."

The Barometer words for *actual* readings (corrected for temperature and instrument error only) run from A to D.

The Cipher words for *actual* readings will not be sent by telegraph except in cases where no constant correction has been furnished to the station by this Office, or where the elevation of the station above sea-level has not been determined.

The Thermometer word will begin with F.

When the sunset prediction is Fair, no word will be enciphered.

When the western sky, at sunset, while exhibiting generally the characteristics of a fair-weather sunset, is tinged, more or less, in different places, with the color of yellow, the word Yellow will be used.

When the sky is tinged with green, the word Vert will be used.

When the sunset prediction is Foul, the word Foul will be used.

When the sunset prediction is Doubtful, the word Doubt will be used.

The Dew Point word will begin with G.

The word for State of Weather will begin with H.

The word for Velocity of Wind, *steady*, will begin with I.

The word for Velocity of Wind, *variable*, will begin with L.

The word for Upper Clouds will begin with O.

The word for Lower Clouds will begin with P.

The word for Rainfall, *when the amount is equal to or exceeds .01 of an inch*, will begin with R.

When the amount of Rainfall is *too small to measure* or less than .01 of an inch, the word "JOHNSON" will be used.

The word for River—Rise—will begin with S, except below bench mark.

The word for River—Fall—will begin with T or U, except below bench mark.

The words for Minimum Thermometer run from V to W.

At river stations, when the river is frozen over, making a gauge-reading impracticable, the word "FROZEN" will be written in the space on Form 203 devoted to the river report until readings are again practicable, but a proper explanation of the cause of the omission of the reading must be made in all records and on all mail reports affected thereby.

At Cautionary Signal stations an additional cipher word will be added to the telegraphic report whenever the maximum velocity of the wind, since the preceding telegraphic report, has equaled or exceeded the rate of twenty-five (25) miles per hour. This word will form the last word of the report, and be taken from the regular velocity words in the cipher-book. When the 11 a. m. observation has been telegraphed to this Office, the maximum velocity at 3 p. m. will be taken since the 11 a. m. observation.

EXAMPLES.

Regular morning report.

Cairo.	Modest.	Fernle.	Gangway.	Hearse.	Lance.
Offward.	Pickle.	Race.	Various.		

TRANSLATION.

Station..... Cairo, Ill.
 Time..... Morning report.
 Barometer, corrected reading..... 29.97.
 Exposed thermometer..... 23°.
 Dew point..... 25°.
 State of weather and direction of wind..... Cloudy—south.
 Velocity of wind and pressure per square foot.... 11 miles per hour, variable—0.60 lb.
 Amount, kind, and direction of upper clouds.... $\frac{A}{10}$ (enciphered $\frac{1}{2}$) cirro-stratus—southeast.
 Amount, kind, and direction of lower clouds.... $\frac{A}{10}$ (enciphered $\frac{1}{2}$) stratus—south.
 Amount of rain-fall since last report..... 0.04 inch.
 Minimum thermometer..... 26°.

NOTE.—The cipher words expressing the minimum temperature, clouds and dew point will not be telegraphed from stations west of the Rocky Mountains. The minimum temperature will not be telegraphed from stations on the same parallel of latitude as Lynchburg, Va., and south of that line, during the months of June, July, and August, stations on the Signal Service Sea Coast Telegraph Line excepted. The minimum temperature will not be telegraphed from Havana, Key West, and Punta Rassa.

Regular evening report.

Denver.	Ensor.	Find.	Gaudy.	Hoist.	Image.
Oldish.	Pig.	Rabbit.	Finish.		

TRANSLATION.

Station..... Denver, Colo.
 Time..... Evening report.
 Barometer, corrected reading..... 30.12.
 Exposed thermometer..... 63°.
 Dew point..... 45°.
 State of weather and direction of wind..... Fair—northwest.
 Velocity of wind and pressure per square foot.... 8 miles per hour, steady—0.32 lb.
 Amount, kind and direction of upper clouds.... $\frac{A}{10}$ (enciphered $\frac{1}{2}$) cirrus—south.
 Amount, kind and direction of lower clouds.... $\frac{A}{10}$ (enciphered $\frac{1}{2}$) cumulo-stratus—south.
 Amount of rain-fall since last report..... 0.01 inch.
 Reading of maximum thermometer..... 67°.

NOTE.—The reading of the maximum thermometer at 3 p. m. will be telegraphed with the 3 p. m. observation from stations east of the Rocky Mountains, Havana, Key West, and Punta Rassa excepted, during the months of May, June, July, August, and September.

Regular midnight report.

Rochester.	Night.	Filch.	Foul.	Gavel.	Hint.
Latent.	Outjest.	Poker.	Raddock.	Incite.	

TRANSLATION.

Station Rochester, N. Y.
 Time Midnight report.
 Barometer, corrected reading 29.68.
 Thermometer, exposed 53°.
 Sunset prediction Foul weather.
 Dew point 47°.
 State of weather and direction of wind Threatening storm—west.
 Velocity of wind and pressure per square foot ... 26 miles per hour, variable—3.38 lbs.
 Amount, kind and direction of upper clouds $\frac{1}{10}$ (enciphered $\frac{1}{4}$) cirro stratus—northwest.
 Amount, kind and direction of lower clouds $\frac{1}{10}$ (enciphered $\frac{1}{4}$) stratus—west.
 Amount of rain-fall since last report 0.09 inch.
 Maximum wind velocity in past 8 hours 30 miles—4.50 lbs.

NOTE.—A word expressing the maximum wind velocity, during the past eight hours, if it has reached 25 miles or over, will be enciphered in the tri-daily telegrams from all cautionary signal stations, except those on the Signal Service Sea Coast Telegraph Line, which will send a tri-daily maximum wind velocity.

Regular river report.

Paul.	Englut.	Fever.	Garland.	Harm.	Incense.
Ovary.	Pegger.	Recede.	Sailor.		

TRANSLATION.

Station Saint Paul, Minn.
 Time Evening report.
 Barometer, corrected reading 29.87.
 Thermometer, exposed 38°.
 Dew point 32°.
 State of weather and direction of wind Fair—east
 Velocity of wind and pressure per square foot ... 28 miles per hour, steady—3.92 lbs.
 Amount, kind and direction of upper clouds $\frac{1}{10}$ (enciphered $\frac{1}{4}$) cirrus—calm.
 Amount, kind and direction of lower clouds $\frac{1}{10}$ (enciphered $\frac{1}{4}$) stratus—east.
 Amount of rain-fall since last report 0.89 inch.
 River 2 feet 6 inches, rising.
 Maximum temperature 38°.

NOTE.—The reading of the maximum thermometer will not be enciphered when it is the same as the exposed thermometer.

When the weather is *calm* and *clear*, and no *rain* has fallen since last report, the cipher words necessary for a morning report, to be transmitted, are, first, *name of station*; second, *barometer, corrected reading*; third, *thermometer*; fourth, *dew point*; fifth, *minimum thermometer*.

EXAMPLE.

Madison.	Model.	Film.	Gaze.	Vessel.	

TRANSLATION.

Station Madison, Wis.
 Time Morning report.
 Barometer, corrected reading 29.95.
 Thermometer, exposed 56°.
 Dew point 50°.

State of weather and direction of wind..... Clear—calm.
 Velocity of wind and pressure per square foot None.
 Amount, kind and direction of upper clouds..... None.
 Amount, kind and direction of lower clouds..... None.
 Amount of rain-fall since last report..... None.
 Minimum thermometer..... 53°.

NOTE.—For a regular *evening* report omit, in the above example, the word for the minimum thermometer and add the proper words for the maximum temperature and depth of river, if any. For a regular *midnight* report omit, in the above example, the word for the minimum thermometer and add the proper word for the sunset observation, if any.

When the weather is *clear*, and no *rain* has fallen since last report, the cipher words for *upper* and *lower clouds* and *rain-fall* will be omitted.

EXAMPLE.

York.	Mood.	Figure.	Gaudy.	Hidden.	Imbibe.
Verdict.					

TRANSLATION.

Station New York City.
 Time Morning report.
 Barometer, corrected reading 30.18.
 Thermometer, exposed 51°.
 Dew point 45°.
 State of weather and direction of wind..... Clear—west.
 Velocity of wind and pressure per square foot.... 9 miles per hour, steady—0.40 lb.
 Amount, kind and direction of upper clouds None.
 Amount, kind and direction of lower clouds None.
 Amount of rain-fall since last report..... None.
 Minimum thermometer 46°.

NOTE.—For a regular *evening* report, omit in the above example the word for the minimum thermometer and add the proper words for the maximum temperature and depth of river, if any. For a regular *midnight* report, omit in the above example the word for the minimum thermometer and add the proper word for the sunset observation, if any.

When the *upper clouds* are *hidden*, and no *rain* has fallen since last report, and the *sunset prediction* is *fair*, the cipher words for *upper clouds*, *rain-fall* and the *sunset prediction* will be omitted.

EXAMPLE.

Detroit.	Nonage.	Finish.	Gentry.	Handy.	Lamb.
Parade.					

TRANSLATION.

Station Detroit, Mich.
 Time Midnight report.
 Barometer, corrected reading 30.16.
 Thermometer, exposed 67°.
 Sunset prediction Fair weather.
 Dew point 60°.
 State of weather and direction of wind Cloudy—northeast.

Velocity of wind and pressure per square foot 8 miles per hour, variable—0.32 lbs.
 Amount, kind, and direction of upper clouds Hidden.
 Amount, kind, and direction of lower clouds $\frac{1}{8}$ (Enciphered $\frac{1}{8}$) stratus—north-east.
 Amount of rain-fall since last report None.

NOTE.—For a regular *morning* report, add the cipher word for the minimum thermometer, and for a regular *evening* report add the word for maximum temperature and depth of river, if any.

In reporting *green, yellow* or *doubtful* sunsets, the words "VERT," "YELLOW," or "DOUBT" will be written *after* the cipher word for the thermometer, and *before* the cipher word for the *dew point*.

When *rain, sleet, or snow* is falling, the cipher words for *upper* and *lower clouds* will be omitted when the former are *hidden* and the latter $\frac{1}{8}$ *nimbus* and *calm*.

EXAMPLE.

Mobile.	Ninham.	Fibre.	Doubt.	Garter.	Home.
Impose.	Johnson.				

TRANSLATION.

Station Mobile, Ala.
 Time Midnight report.
 Barometer, corrected reading 29.81.
 Thermometer, exposed 41°.
 Sunset prediction Doubtful weather.
 Dew point 39°.
 State of weather and direction of wind Light rain—northwest.
 Velocity of wind and pressure per square foot 21 miles per hour, steady—2.20 lbs.
 Amount, kind, and direction of upper clouds Hidden.
 Amount, kind, and direction of lower clouds $\frac{1}{8}$ nimbus—calm.
 Amount of rain-fall since last report Inappreciable.

NOTE.—For a regular *morning* report omit the word for the sunset prediction and add a word for the minimum thermometer, and for a regular *evening* report, omit the sunset prediction and add words for the maximum temperature and depth of river, if any.

When the weather is *cloudy* or *threatening*, and the *upper clouds hidden* by the sky being covered with *stratus clouds calm*, the cipher words for the *upper* and *lower clouds* will be omitted. When over four inches of rain have fallen in the past eight hours, two cipher words for rainfall will be used.

EXAMPLE.

Washington.	Nimbles.	Festoon.	Foul.	Garden.
Hold.	ImPLY.	Rutledge.	Rabbit.	Killing.

TRANSLATION.

Station Washington, D. C.
 Time 11 p. m. report.
 Barometer, corrected reading 29.74.
 Thermometer, exposed 34°.
 Sunset prediction Foul.

Dew point.....	30°
State of weather and direction of wind.....	Cloudy, N. W.
Velocity of wind, miles per hour, and pressure per square foot.....	19 miles and 1.80 lbs. steady.
Amount, kind, and direction of upper clouds....	Hidden.
Amount, kind, and direction of lower clouds....	$\frac{1}{8}$ stratus, calm.
Amount of rain-fall in past 8 hours.....	4.01 inch.
Frost.....	Killing frost.

NOTE.—For a regular *morning* report omit, in this example, the sunset prediction and add the cipher word for the minimum thermometer. For a regular *evening* report omit the sunset prediction and add words for the maximum thermometer and depth of river, if any. On the occurrence of the first frost of the season at any station the word “FROST” or “KILLING,” as the case may be, will be added to the next succeeding telegraphic report.

The thunder-storm cipher word for the state of the weather will be used when it is raining at the moment of observation and the rain is the continuance of a thunder-storm, whether thunder is heard or lightning observed at that moment or not.

When the 11 a. m. or 7 p. m. observations are called for by telegraph from this Office, the data will be sent in the following form as a telegram, always omitting the rain-fall:

Example.

DAKOTA, 7th.

Signals, WASHINGTON.

Eleven, monkey, first, gig, hum, ignite, petty, fix, imp.

PENROD, *Sergeant*.

Translation.

Station	Huron, Dakota.
Date	7th day of month.
Time	11 a. m.
Barometer, corrected	30.11 inches.
Thermometer, exposed	74°.
Dew point	70°.
Weather	Light rain and thunder-storm.
Direction of wind	South.
Velocity of wind	4 miles, .08 lbs.
Upper clouds	Hidden.
Lower clouds.....	$\frac{1}{8}$ nimbus, from S. E.
Maximum temperature.....	82°.
Maximum wind velocity.....	12 miles.

NOTE.—For the 7 p. m. observation omit the the words “Eleven, monkey” and add “Seven, ensnare.” These special reports will be sent as soon as possible after the observations are taken, when called for.

When rain, snow, hail, or sleet have occurred since the last telegraphic report, and the quantity collected in the gauge is not sufficient to measure at the time of observation, the cipher word “Johnson” will be written on Form 203, in the proper space to indicate the precipitation inappreciable.

In enciphering telegraphic reports the *second* barometrical decimal figure will be increased by one when the *third* exceeds 5.

Reports will not be telegraphed or filed for telegraphic transmission, if twenty-four hours old, without special instructions from proper authority. For example, during the morning report hour the current report “M,” and the reports for the preceding midnight, “N,” and afternoon, “E,” may be sent, if the two latter could not have been sent at the regular schedule-hours.

The observer in charge of each station where reports are transferred from one circuit to another will be held strictly responsible for all trans-

fers, and the cost of transmitting all improper or unauthorized reports beyond his station will be charged against his pay.

The duplicate copies of the report for each day will be mailed weekly to this Office from all telegraphic stations.

The cipher words expressing minimum temperature, clouds, and dew point, will not be telegraphed from the following stations:

Stations west of Rocky Mountains.—Dayton, Spokane Falls, and Olympia, Washington Territory; Lewiston, Idaho; Portland, Umatilla, and Roseburg, Oregon; Red Bluff, Sacramento, San Francisco, Visalia, Los Angeles, and San Diego, California; Pioche and Winnemucca, Nevada; Salt Lake City, Utah; Ft. Apache, Tucson, Yuma, and Prescott, Arizona; Silver City and Santa Fé, New Mexico; El Paso, Texas.

From June 1st to August 31st, inclusive of each year, the cipher word expressing minimum temperature will not be telegraphed from the following stations:

Lynchburg and stations south of latitude of same.—Atlanta, Augusta, Cairo, Charleston, Charlotte, Chattanooga, Cedar Keys, Corsicana, Ft. Gibson, Galveston, Indianola, Jacksonville, Knoxville, Little Rock, Lynchburg, Memphis, Montgomery, Nashville, New Orleans, Pensacola, Port Eads, Savannah, Shreveport, Vicksburg, Brownsville, Concho, Denison, Eagle Pass, Ft. Sill, Ft. Elliott, San Antonio, and Stockton.

In future the cipher words expressing maximum and minimum temperatures will not be telegraphed from Key West, Punta Rassa, and Havana.

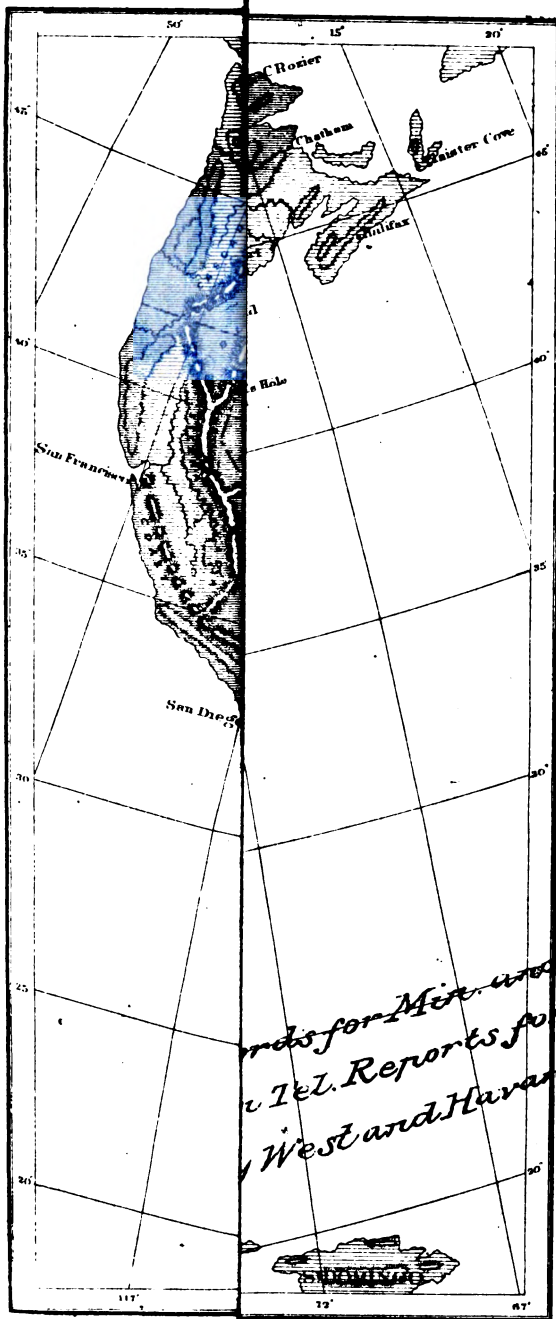
From May 1st to September 30th, inclusive, of each year, a cipher word to express the reading of the maximum thermometer at the 3 p. m. (Washington time) observation will be added to the afternoon telegraphic report from the following stations:

Stations east of Rocky Mountains.—Albany, Atlanta, Alpena, Augusta, Boston, Buffalo, Burlington (Vt.), Cairo, Charleston, Charlotte, Chattanooga, Cedar Keys, Cheyenne, Chicago, Cincinnati, Cleveland, Columbus, Corsicana, Davenport, Denver, Des Moines, Dodge City, Dubuque, Duluth, Eastport, Erie, Escanaba, Ft. Gibson, Galveston, Grand Haven, Indianapolis, Indianola, Jacksonville, Keokuk, Knoxville, La Crosse, Leavenworth, Little Rock, Louisville, Lynchburg, Marquette, Memphis, Milwaukee, Montgomery, Mt. Washington, Nashville, New Orleans, New Shoreham, New York, North Platte, Omaha, Oswego, Pensacola, Pittsburgh, Port Eads, Port Huron, Portland (Me.), Sandusky, Savannah, Shreveport, Springfield (Ill.), St. Louis, St. Vincent, St. Paul, Toledo, Vicksburg, Yankton, Moorhead, Eagle Rock, Assiniboine, Benton, Ft. Buford, Ft. Custer, Ft. Keogh, Ft. Bennett, Ft. Missoula, Ft. Stevenson, Helena, Ft. Shaw, Bismarck, Deadwood, Brownsville, Concho, Denison, Eagle Pass, Ft. Sill, Ft. Elliott, San Antonio, and Stockton.

When the maximum temperature is the same as the exposed reading the latter only will be telegraphed. The cipher words on page 32 of the Telegraphic Cipher will be used for this purpose, and the word on Form 203 will follow the rainfall. These special readings will be made without disturbing the maximum thermometer and entered on the Original Record, but on no other forms sent to this Office.

The accompanying chart shows the section of the country to which the above paragraphs apply.

Form 204 (old Form 2) is for the use of the telegraph operators in receiving the reports from other stations, and will be furnished by the observers in such quantities as may be required, care being taken to guard against wasteful and unnecessary use. The spaces will be filled up in regular order, commencing at the upper left-hand space, and filling



each space to the right in succession on the first line and then commencing at the left-hand space on the second line, and so on. Observers will require the receiving operators to sign and date each sheet, and also to note the time the reports upon it were received, before taking it from the telegraph office. The time of receipt from the operator will be noted by the observer or assistant. When the reports are received in duplicate by the operator, observers will retain the original sheets furnished them by this Office.

After the reports have been translated and entered in the Bulletin, the receiving-sheets for each full report will be placed together, and folded neatly in three folds, parallel with the writing.

Each morning the three reports of the preceding day will be secured together so as to form a single package. At the end of each week the seven daily packages for the week will be put up in one neat package, and forwarded by mail to this Office, with the name of station plainly written upon the outer fold of the outside sheet.

Form 205 (old Form 9) (operator's wire report O. C. S. O.) This report for each circuit will be made out at each signal circuit hour by the operator working that circuit. It must state the time of starting and closing circuit with reasons for delay if not started on time. All delays in receipt of schedule reports with reasons therefor, and all trouble on the wire or interruptions in working of the circuit, must be noted. Any trouble on the wire must be reported at once to the Chief Operator, Western Union office, Washington, and the fact noted. All reports missing at the close of the circuit will be entered on Form 205, and the reason for non-receipt stated. The time of receipt of weather reports by special messages will be noted with a list of missing reports and reasons for failure as given by cipher words accompanying these reports. The wire reports for the three preceding circuit hours will be submitted to the officer in charge of stations for his inspection each morning.

Form 206, "Up Signals" order, is used for all orders for cautionary signals to cautionary and display stations and is issued by the officer in charge of the indication room at this Office. The order must be carefully dated and timed in the upper right-hand corner of the Form. It must be addressed to "Observer" and give the names of stations at which cautionary signals are ordered, and contain the words "Up Signals" followed by an explanatory descriptive message, stating the location of the storm center, direction in which it is moving, or other information deemed necessary. In making out cautionary orders for a number of stations, only those in the same general locality should be included on the same form, viz: Those in the Lake region, on the Gulf coast, on the South Atlantic coast from Jacksonville to Charleston, on the North Atlantic coast from New York to Eastport, and those on the Sea Coast Telegraph Line. When signals are ordered for both distributing stations and "Display Sections" the number of section must immediately follow the name of distributing station for that section. The order when written will be taken to the telegraph room and placed in the hands of an operator, who will at once note the time of its receipt by him in the lower left-hand corner and also insert the time before the words "Up Signals," the time to be included in the body of the message and transmitted to the observer. The operator will write a "notification" for each station where one is required, transmit the message with the least possible delay, and note the time of sending the order in the lower right-hand corner. The time of sending the order to each station will also be entered over the name of that station and in the column headed "Up Signals" on Form 210, opposite

of the station, and the proper date being placed at head of the column. The order will then be filed with other telegrams sent.

Form 207, "Hoist Off-Shore Signals" order. This order is issued by the officer in charge of the indication room when high winds blowing off-shore are anticipated at stations on the Atlantic or Gulf coasts. The order will be prepared and treated in same manner as "Up Signals" order.

Form 208, "Hoist Northwest Signals" order, issued by the officer in charge of the indication room when high northwest winds are expected at stations on the lakes.

Form 209, "Signals Down" order, is issued by the officer in charge of the indication room to observers to lower signals when no further danger from storm is anticipated.

Form 210 (old Form B), Cautionary Signal order sheet (O. C. S. O.), is used in the telegraph room at this Office for a record of the time at which all signal orders are sent from this Office, received by observer, and acknowledgments of receipt of orders are received at this Office. These three entries must be made under the subheadings between the double lines and opposite the name of the station, and the date placed at the head of each column.

All entries of, and references to, Up Signals, including Off-Shore and Northwest Signals, must be made in black ink, and all entries of "Down Signals" in red ink. This form will be submitted to the officer in charge of stations for inspection daily.

Form 211 (old Form B). Weekly abstract of messages sent and received.

All messages sent and received, including Indications, will be entered on Form 211, except regular weather reports sent over regular circuits. The account will be kept by messages, whether they consist of one or more reports or messages from one or more stations. The originals of all received messages, and copies of all messages sent, must accompany this form, which will be forwarded with the other weekly reports of the stations. The name of the station must always be indorsed upon the back of this form.

Form 212, Weekly Line Report, will be forwarded by the officer in charge of each division of the United States Military Telegraph Lines to this Office. The name of each station in the division from which telegraphic weather reports have been received will be written in one of the blank spaces on the left side of the sheet, and the time of the receipt of reports entered in the proper spaces. If reports are received "on time" these words must be written in black ink in the small spaces. Time of receipt of late reports must be entered in red ink, and a note made under the head of "Remarks," giving the cause of delay. Missing reports will be so noted in red ink.

One Form 212 will be made out weekly by the sergeant in charge of the telegraph room at this Office, for the Coast Telegraph Line, and for each division of the United States Military Telegraph Lines, the data to be obtained from the Coast Log Book, Form 204, and wire reports at this Office.

Form 213, Repairman's Weekly Trip Report, sea-coast line, for stations on the Sea Coast Telegraph Line, will be forwarded to this Office by mail, weekly.

All regular and special repair trips will be entered on this form. Expenses incurred on each trip, if any, must be entered plainly in the column headed "Expenses." Under the head of "Remarks" will be noted any necessary explanations not covered by the printed headings.

If no repair trip has been made during the week this fact will be stated on the form.

A telegraphic report will also be made to this Office upon repairman's return to station after each trip.

214 (old Form 8), U. S. Tel., Repairman's Trip Report, for repairmen on United States Military Telegraph Lines. One copy must be forwarded to the Officer in charge of division upon return from each repair trip. The directions given in notes in the margin must be strictly complied with. All items of expenses must be carefully entered in the proper column.

Form 215, Working Form of Circuit is made out at this Office for the use of observers and operators at stations which send or receive reports over telegraphic circuits. It gives the names of stations whose reports go over each circuit, times of transmission of reports, and the order in which they are to be sent.

Observers will exercise especial care to see that reports are properly transmitted and received by telegraph operators in compliance with instructions given on the form.

Form 216 U. S. Tel., Monthly Report of Press received, is to be used at stations on the United States Military Telegraph Lines receiving press news by telegraph for the benefit of officers and others at military posts. Copies of all news thus received will be delivered at the office of the commanding officer daily as soon as received, and the signature of the party receiving the same and the time delivered to him will be taken on this form. The number of words received each day, and the time received by the operator, will be entered on the form by the operator receiving the reports. In case no news is received, the reason for failure will be given in the last column.

One copy, properly filled up and signed by the operator in charge of the station, will be mailed at the end of each month to the officer in charge of the division.

Form 217 U. S. Tel., Monthly Return of Detachment, is a monthly report made to this Office by the officers in charge of divisions of United States Military Telegraph Lines of all enlisted men and civilians employed, with the name of station and the nature of the duty performed by each man.

In making out this form particular attention will be paid to directions contained in the notes at the bottom of the form.

Form 218 U. S. Tel., Monthly Labor and Material Report, is a monthly statement of repairs made and materials expended by repairmen on United States Military Telegraph Lines.

Repairers will carefully read the instructions printed on the back of this Form, and strictly observe them in making entries thereon. The amount of line material on hand at the end of the month must always be entered.

All expenditures incurred during the month must be reported on this form; but credit therefor will not be taken on accounts current until vouchers for amounts have been approved by the officer in charge.

The report will be forwarded by mail to the Officer in charge of the Division.

Forms 219; 220, and 221 are special forms designed for use at the Delaware Breakwater only.

Form 222, Skeleton Message Blank, is used at the Office of the Chief Signal Officer as a record of special messages containing weather reports sent to this Office in that manner. These messages will be entered by the operator receiving them. The place from, office number,

time received, number of words, check, operator's private signals, and the office received from, will be entered on one line in the above order.

Form 223, Notification of Signal Orders. When cautionary or other signals are ordered up or down at the stations on the Lakes or the Gulf, a notification of the fact will be sent by telegraph to other stations in the same locality as directed below.

The notification, besides the information that "Up," "Off-Shore," "Down Signals," &c., are ordered for other stations, will contain the explanatory message embraced in the cautionary order. When signals are ordered up or down at any of the stations on the Gulf Coast, viz, Key West, Cedar Keys, Pensacola, Mobile, New Orleans, Port Eads, Galveston, and Indianola, notifications will be sent to all of these stations.

On the Lakes, when signals are ordered for Duluth or Marquette, notify Duluth, Marquette, Escanaba, Milwaukee, Grand Haven, Chicago, Mackinaw City, Alpena, Port Huron, and Detroit. When ordered for Escanaba, Milwaukee, section 1 or 2, Grand Haven, Chicago, Mackinaw City, Alpena, Port Huron or Detroit, notify all Lake stations. When ordered for Detroit, section 3 or 4, Toledo, Sandusky, Cleveland, section 5, Erie or Buffalo, notify all Lake stations except Duluth and Marquette. When ordered for Rochester, Oswego or section 6, notify Detroit, Toledo, Cleveland, Sandusky, Erie, Buffalo, Rochester, and Oswego.

The observer at New York will be notified of all changes in cautionary signals at any station on the Atlantic or the Gulf Coasts. This notification will be sent over the coast wire via Sandy Hook if possible. When the coast wire is down they will be sent by the Western Union.

INSTRUCTION.

Form 301, Weekly Report of Officers Instructed.

Form 302, Weekly Report of Enlisted Men Instructed at Fort Myer, Va.

Form 303, Weekly Report of Telegraph Practice of Enlisted Men at Fort Myer, Va.

Form 304, Monthly Station Instruction Report.

Form 305, Monthly Report of Officers Instructed in Military Signals.

Form 306, Monthly Report of Enlisted Men Instructed in Military Signals.

Form 301 will be used at this Office and at Fort Myer for reporting progress made by officers undergoing instruction, and will show the hours of recitation, subjects of study, and the proficiency and character of the recitations of each officer, estimated on a scale of from zero (0) to three (3), three (3) being a perfect recitation.

Form 302 will be used at Fort Myer for reporting progress made by enlisted men undergoing instruction. Upon this form will appear the names of enlisted men under instruction, arranged in classes, classes being separated by red horizontal lines. Proficiency in recitations will be indicated on a scale of from zero (0) to three (3). Subjects of recitation for each class will be accurately stated. In the column for "Remarks" all changes which have occurred in classes during the week, and the names of those awaiting examination, ordered on station, &c., will be noted.

Form 303 will contain the names of all enlisted men undergoing instruction in telegraphy at Fort Myer, Va., arranged in the order of their proficiency at the last report. Under the head of "Progress" will be

noted the number of words per minute which each man can send and receive at a regular rate of speed.

Form 304, the Report of Instruction, is a monthly form, to be made out and forwarded immediately after the close of the month from all stations.

Recitations will be had weekly, and the report will show the character of each recitation.

In reporting recitations on this form, the number of the page at which the lesson in each text-book used began and ended must be given.

The enlisted men on duty at stations where there is an assistant will be required to practice one hour each week with the wand.

The practice will be duly noted on this form, and the number of words per minute which each man can send and receive in the General Service Code will be given.

Where there is but one enlisted man at a station he will be required to continue his studies in the various text-books provided for use on station, and this report will show the portion of the course of study reviewed during each week of the month.

Forms 305 and 306 are the monthly reports of officers and enlisted men (respectively) instructed in military signals in the different military departments. Instructions for preparing these forms are printed on the back.

125. The following will be the course of instruction for enlisted men at Fort Myer, Va:

First, Cavalry Tactics.

To be recited upon during first two months that the recruit is at Fort Myer and before he is regularly placed under class instruction.

1st Lesson, to par. 32, page 15.

2nd " from par. 32, page 15, to "Manual of Sabers," page 27.

3rd " "Manual of the Carbine," page 46, to par. 149, page 55. .

4th " from par. 149 to bottom of page 66.

5th " "School of Company Dismounted," page 73, to par. 221, page 84.

6th " from par. 221 to par. 259, page 99.

7th " from par. 259 to end of "School of Company Dismounted," page 113.

Second, Manual of Signals—Myer.

1st Lesson, to "Naval Signals," page 49.

2nd " from "Naval Signals" to "Field Signals of one Element," page 65.

3rd " from page 65 to bottom of page 83.

4th " from "Description of Equipments," page 189, to "Candle Bombs," page 207.

5th " from "Telescopes and their Uses," page 231, to "Scale Glasses," page 238, and "Manual of the Kit," page 261, to middle of page 276.

6th " from "Field Telegraph Train," page 381, to "To Recover the Line," page 390.

7th " from page 390 to "General Directions," page 396.

8th " review 1st, 2nd, and 3rd advance lessons.

9th " review 4th and 5th advance lessons.

10th " review 6th and 7th advance lessons.

Third, International Code of Signals.

- 1st Lesson, from Page XII to "Boat Signals," Part III.
 2nd " "Boat and Coast Signals," Part III, to par. 12, page 12, and
 "Signal Service Official Distress and Danger Signals."

Fourth, Hand Book of Practical Telegraphy—Culley.

- 1st Lesson, to par. 25, page 10.
 2nd " from par. 25 to par. 57, page 21.
 3rd " from par. 73, page 29, to par. 95, page 40.
 4th " from par. 95 to par. 102, page 48.
 5th " from par. 114, page 58, to bottom of page 69.
 6th " from "Electro Magnetism," page 70, to par. 167, page 82.
 7th " from par 194, page 96, to "Earth Currents," page 110.
 8th " review 1st, 2nd, and 3rd advance lessons.
 9th " review 4th and 5th advance lessons.
 10th " review 6th and 7th advance lessons.

Fifth, Modern Practice of the Electric Telegraph—Pope.

- 1st Lesson, Chap. IV to par. 70, page 42.
 2nd " from par. 70 to par. 77, page 47, and from par. 87, page 57,
 to par. 103, page 64.
 3rd " Chap. VI to par. 122, page 78, and Chapters VII and VIII.
 4th " review Chapter IV to par. 77, page 47.
 5th " review from par. 87, page 57, to par. 103, page 64, and
 Chapter VI to par. 122, page 78, and Chapters VII and
 VIII.

Sixth, Manual of Signals—Myer.

- 1st Lesson, from "Permanent Lines," page 402, to bottom of page 425.
 2nd " from top of page 426 to middle of page 448.
 3rd " from page 448 to "Telephones," page 469.
 4th " "Telephones."
 5th " review 1st and 2nd advance lessons.
 6th " review 3rd and 4th advance lesson.

Seventh, Meteorology—Loomis.

- 1st Lesson, Chapter I.
 2nd " Chapter II to par. 52, page 34.
 3rd " from page 34 to bottom of page 53.
 4th " Chapter III.
 5th " Chapter IV to par. 140, page 79, omitting par. 125 and 126.
 6th " from page 79 to Section II, page 93.
 7th " from Section II to bottom of page 107.
 8th " Section V to page 122.
 9th " Section VI to Chapter VI, page 136.
 10th " Chapter VI to Section II, page 147.
 11th " Section II to Chapter VII, page 160.
 12th " Chapter VII to Section III, page 173.
 13th " "Auroras" to par. 383, page 193, omitting par's 357 to 369
 inclusive.
 14th " review to par. 70, page 44.

- 15th Lesson, review from page 44 to par. 140, page 79.
 16th " review 6th and 7th advance lessons.
 17th " review 8th and 9th advance lessons.
 18th " review 10th and 11th advance lessons.
 19th " review 12th and 13th advance lessons.

Eighth, Instructions to Observers.

PRACTICAL COURSE.

Wand practice one hour daily, from time of reporting at Fort Myer until ready for field signaling.

Telegraph Practice—Morse Code.

Daily, three hours, until a rate of 15 words per minute (receiving) is attained, two hours until a rate of 20 words, and one hour until a rate of 25 words. Men attaining the latter rate will be excused from regular practice.

Military Signaling.

12 days and 4 nights, General Service Code, short and 4-mile ranges; 3 days, International Code.

Practical Duties of Meteorological Observers.

10 days in the observatory. Men to be instructed in the use of and method of cleaning and keeping in order all instruments in use at the observation offices of the Signal Service and in making out all the different meteorological and property forms required from observers.

All enlisted men, except "field-service" men, will be instructed in the use and connections of the Marean repeater, telephones and call-bells, setting up and cleaning of batteries, use of, construction and connections of Morse and other instruments used in the Signal Service Telegraph Offices, method of splicing and connecting submarine cable and land lines, establishing terminal and intermediate stations, and finding the position of and repairing faults in telegraph lines and instruments.

Recruits will not be placed under class-instructions until they have been two months at Fort Myer. During this time they will be required to recite in Tactics and to attend Wand and Telegraph practice when not on guard.

The following are the subjects which will be included in the examination of Sergeants of the Signal Corps, candidates for promotion to Second Lieutenants:

An Examining Board will meet at this Office, at such time as may be necessary, for the purpose of examining such Sergeants of the Signal Corps as may be ordered by the Chief Signal Officer to appear before it. The examination will be made for the purpose of selecting from among the Sergeants the two most worthy of being recommended for promotion to Second Lieutenants in the Signal Corps of the Army.

The examination of each Sergeant will embrace the following subjects:

First. In his knowledge of English grammar, and his ability to read and write with facility and correctness.

Second. In his knowledge of arithmetic, and his ability in the application of its rules to all practical questions. In his knowledge of the use of logarithms, and ability to apply them to questions of practice. In his knowledge of algebra, to the solution of simple equations, and in his knowledge of plane geometry and the elements of surveying.

Third. In his knowledge of geography, particularly in reference to the northern

continent of America, and in his ability to solve the usual problems on the terrestrial globe. Also, in his knowledge of what is usually denominated popular astronomy.

Fourth. In his knowledge of history, particularly in reference to his own country.

Fifth. In his knowledge of the Constitution of the United States, and of the organization of the government under it, and of the general principles which regulate international intercourse.

Sixth. In his knowledge of "Elementary Treatise on Natural Philosophy by Dea-chanel": Part I (mechanics, hydrostatics, and pneumatics); Part II (heat); Part III (electricity and magnetism), and Part IV (sound and light).

Of all the above subjects successful candidates should possess a good knowledge.

Seventh. Examination into mental and moral qualification should cover the history of the person examined, and establish for a successful candidate a continuously sound mental condition, excellent moral character, a good character for sobriety and fidelity, as well as an intelligent, energetic, judicious and faithful performance of such duties as may have been devolved upon him in the Army.

The board will report the order of relative merit of all the candidates examined.

126. All weekly reports to this Office must be mailed not later than Monday of the week succeeding that of which they form the record. If they are delayed beyond this date, a statement of the cause of delay must be forwarded in the same package.

127. Observers must bear in mind that every form made out must be complete in itself, and no part of the data which it is intended to contain should be left out and the deficiency supplied by reference to another form or report; and when any portion of a report is omitted, or is not sufficiently clear to be understood by a person unfamiliar with it, a proper explanation thereof must be made on such form or report.

BOOKS OF REFERENCE AND RECORD.

128. The following books of reference and record are furnished by this Office for station use:

For Reference.

Guyot's Meteorological Tables.

Buchan's Handy Book of Meteorology.

Loomis's Treatise on Meteorology.

Myer's Manual of Signals.

Piddington's Horn Book.

Manual of Military Telegraphy.

Annual Reports of the Chief Signal Officer.

Practical use of Meteorological Reports and Weather Maps.

Instructions to Observers, Signal Service, United States Army.

Smithsonian Directions for Meteorological Observations.

Daily Bulletin (Synopses, Indications, and Facts).

Pope's Telegraphy.

Holy Bible.

Webster's Counting House and Family Dictionary.

International Code of Signals.

American Lloyd's Register of American and Foreign ship-
ping.

American Shipmasters' Record of American and Foreign
shipping.

Register of Officers and Vessels of the U. S. Revenue Marine.

} At coast
stations.

For Record (Meteorological).

Journal.

Book of Monthly Meteorological Report (Form 113 A).

Record Bulletins.

Record of Letters Sent.
 Record of Letters Received.
 Original Record of Observations.
 Record of Cautionary Signals.
 Record of Postage Stamps.
 Monthly River Record.
 Expense Book.

One copy of the "Monthly Weather Review" will be furnished to each station to be kept on file for reference.

129. When copies of reports or other books are sent from this Office for distribution, preference must be given to the members of the meteorological committees, to public libraries, educational institutions, and scientific men. One copy of each report or book received must be kept permanently in the office for reference.

DAILY JOURNAL.

130. In the Daily Journal will be entered all matters of interest not provided for in the various forms, such as the meteoric and auroral displays, earthquakes, sunsets verifications, and unusual atmospheric appearances and disturbances, giving in each case, when possible, the time of beginning and duration of each. Whenever a meteor is seen by any observer, the "cloud" left by the meteor will be carefully noticed, both as to its appearance and the direction in which it *floats*, and a record and full description of the meteor and cloud will be entered. Especially will the observer enter a detailed account of the characteristic phenomena of every storm that passes over his station, and endeavor to give such information as will be of interest in making up the "Monthly Weather Review."

131. Observers will be particular to note in the Journal every display of aurora, seeking by inquiry of others, if necessary, to make their record complete.

If the sky is obscured by clouds, so that the aurora, if present, cannot be observed, the word "obscured" will be entered in that part of the record devoted to auroral displays. If the sky is sufficiently clear for observation, the words "aurora" or "no aurora" will be entered, according as one is visible or not. When observed, a full account of the phenomenon will be entered in the journal, showing the exact minute of its beginning and ending, and the principal phases that it experiences. The following particulars should be especially noted: the azimuth and altitude of each extremity and of the crown of any arch of light, and the same data for any corona or glory that may be formed.

When the observer is familiar with the names of the principal fixed stars, he may locate the arch or crown by reference to them, but it is preferable that he should observe directly the altitude and azimuth.

132. Altitudes are expressed by degrees from the horizon to the zenith. If any circle be divided into three hundred and sixty parts, and the radial lines connect these parts with the center, each pair of lines subtend an angle of one degree; the fourth part of the circle will subtend an angle of ninety degrees or one right angle, and the corresponding radii are perpendicular to each other; thus the zenith (that point of the heavens immediately above the observer) is ninety degrees from the horizon, or, in other words, its altitude is 90° . A point half way up from the horizon to the zenith has an altitude of 45° .

Azimuths are also expressed in degrees, but are measured on the horizontal plane, and will be recorded as is done in astronomy, from the

south point to the westward, passing, successively, the west, north, and east points of the compass until 360° have been passed over, and the south point is again reached.

133. Observers must be particular as to the date of the aurora; and when it begins in the evening of one day and continues into the early morning of the next day, it will be entered as occurring on the *first* day, but its details will be given in the record as occurring between the hours of its actual beginning and ending. Thus, an aurora that began on the evening of the 12th of January, and continued until the early morning of the 13th, would be entered as the aurora of the 12th, but its details would be recorded as occurring, for instance, between the hours of 10 p. m. of January 12, and 2 a. m. of January 13.

134. All entries in the Journal of occurrences and observations of any one day will be made under that day, and not for a subsequent date. For example: an auroral display occurring May 23, should be entered under that date, and not referred to, on the 24th, as having occurred "last evening."

135. At stations west of the Mississippi River observers will note the date of appearance of Rocky Mountain locusts; the direction from which they come; the direction and velocity of wind and character of weather at time of appearance; the length of time they remain in the neighborhood of the station, and amount of damage done by them; the direction and velocity of flight; direction of flight when they leave; whether they fly with or against the wind; whether or not they laid eggs in great quantities in the surrounding country; what means were taken to destroy the eggs or the locusts, and any other information that can be obtained on this subject. In addition to this a summary in regard to their appearance, numbers, damage done, &c., &c., will be made as the concluding part of the Abstract. Immediately after the 30th of June, of each year, a report on the Rocky Mountain locusts, giving the following data covering the period from the first of July preceding, will be made:

(1.) Date and time of day of the arrival of swarms; 1*a*, direction and force of wind at the time; 1*b*, temperature and character of the weather at the time (clear or cloudy); 1*c*, direction of the flight, density, and extent of swarms.

(2.) Date and time of day of the departure of swarms; 2*a*, direction and force of the wind at the time; 2*b*, temperature and character of the weather at the time; 2*c*, direction of the flight, density, and extent of swarms.

(3.) Date when the first eggs, if any, were deposited during the year.

(4.) Date when the eggs were most numerous hatching during the year.

(5.) Nature of the soil and situations in which the eggs were most largely deposited.

(6.) Nature of the soil and situations in which the young were most numerous hatched.

(7.) Date at which the first insect acquired full wings.

(8.) Date when the winged insects began to migrate.

(9.) Estimate the injury done in the county and State.

(10.) Crops which suffered most.

(11.) Crops most easily protected.

(12.) Crops which suffered least.

(13.) The prevailing direction in which the young insects traveled, and any other facts in relation to the marching of the young.

(14.) The means employed for the destruction of the unfledged insects,

or to protect crops from their ravages, and how far these have proved satisfactory.

(15.) The means employed for the destruction of the winged insects, or to protect crops from their ravages, and how far these have proved satisfactory.

(16.) Descriptions, and, if possible, figures of such mechanical contrivances as have proved useful for the destruction of either the young or the winged insects.

(17.) To what extent have birds, domestic fowls, and other animals, domestic or wild, been useful in destroying these insects?

136. Observers must pay particular attention to accuracy in the use of the terms "*morning*" and "*evening*," and will be governed by the following instructions in reference to them:

Midnight is the moment, 12h. 00m. 00s., and is the beginning or first moment of the new day, and should receive the date of that day. Thus, whatever happened in the evening of June 10, at 11h. 59m. 59s., happened at 11h. 59m. 59s. *p. m.* June 10; whatever happened one second later was at midnight of June 10 and 11, and at one second later at 12h. 00m. 01s. *a. m.* of June 11. At midday of latter date, whatever happened at 11h. 59m. 59s., happened at 11h. 59m. 59s. *a. m.* June 11; at one second later it was noon June 11; at one second later it was 12h. 00m. 01s. *p. m.* June 11.

137. A monthly abstract of the entries in the Journal will be mailed to this Office from stations east of the 100th meridian as soon as possible, and not later than the 3d day of each month. At stations west of that meridian they must be mailed as soon as possible and not later than the 2d of the month. This abstract must contain all the important entries of the Journal, especial care being taken to exclude all matters relating to the ordinary routine of observations that are given on the various forms. The abstract should show clearly and briefly all matters of interest not provided for in the regular forms, such as flight of birds, early vegetation, the movement of the Rocky Mountain locust (at stations west of the Mississippi River), meteoric and auroral displays, earthquakes, thunder-storms, distant lightning, high winds and gales, the occurrence of frost (particularly first frost and first killing frost), first ice, fog, polar bands, zodiacal light, and other unusual atmospheric phenomena, giving, whenever practicable, the time of beginning and duration of each. In each day's abstract the subject of auras and the character of the sunset will be briefly noted in the authorized manner.

Whenever a tornado occurs in the vicinity of any station the observer will make diligent effort to obtain an accurate description of all meteorological elements accompanying the tornado; the hour and date of occurrence; direction of movement; appearance of the clouds; direction of the whirl; rain-fall; accompanying noise; length of track; average width at different points; amount of destruction to life and property, &c. So much of this information will be given as can be learned without leaving station for such time as to require special permission. The report required by these Instructions will be entered in the Journal, and also reported to this Office on Form 136.

138. The following additional subjects will be noted: all changes in the working-force of the station, with the date and nature of such change; all movements of office or instruments, with date of such movement, changes in elevation, and authority for making the same; and the fact that the battery cells have been wiped on Saturdays. The condition of instruments and of other public property will form the

closing part of each abstract—the instruments named separately, and the official number and the correction for instrumental error of each one given. When any instrument is reported unserviceable or out of order the nature of the fault will be stated, and also whether a new one is required to replace it. When repairs can be made on station, this fact will be stated, with estimated cost.

139. At river-stations, all special phenomena affecting navigation will be noted, such as the date of high and low water during the month, with monthly range at station; closing of the river by ice, or from any other cause; formation of ice or other gorges, with effect upon navigation, &c.

140. At lake and sea-coast stations the opening and closing of navigation, with the name of the first vessel to arrive and the last one to depart, with the nature of the cargo in each case, and the number of Cautionary, Off-shore and Northwest Signals displayed during the month will be reported, with results as far as known at each station; number of storms that passed over station for which Signals were not ordered, dates, with velocity of wind, being stated in each instance; and at all stations a summary of the sunset predictions, the number of each kind verified and the number not verified, will be made, and in case one or more predictions may have been missed, an explanation of their absence must be made in the summary. When "yellow or green" sunsets are observed, the amount of the western sky exhibiting such color must be noted in the Journal and reported in the Abstract.

141. Each abstract must show at its head the name of the station and month for which it is prepared, and at its close the official signature of the observer making it. To facilitate reference, marginal notes will be made in red ink at the left of the vertical line on each page, upon the prominent subjects mentioned in the text, as "Aurora," "Rain," "Snow," "Hail," "Earthquakes," "Removal of Office," "Thunder-storms," "Fog," "Frost," "First ice," "Battery attended to," &c.

142. All abstracts must be written on legal-cap paper, on one side of the paper only, and, when completed, the sheets will be securely fastened together at the top. The blank furnished by this Office, entitled "Contents of Abstract of Journal," must always accompany the abstract.

143. The following Abstract of Journal will illustrate the nature of subjects to be used in Station Abstracts, and the order in which they should follow each other. As the example given here was prepared to cover the several varieties of stations, it is not probable that *all* the phenomena will be noted at any one of them.

ABSTRACT OF DAILY JOURNAL FOR THE MONTH OF DECEMBER, 1880.

Frost. Thick fog.	STATION.
	NEW YORK CITY, N. Y.
	1st. Heavy frost in the morning. During the day southerly winds prevailed, with thick fog from 10 a. m. to noon, when it cleared off; clear for the remainder of the day. No aurora. Foul weather sunset. Verified.

Abstract of Daily Journal, &c.—Continued.

	2d.
Rain.	Easterly winds and increasing cloudiness, with rain from 10.40 a. m. to 3.20 p. m.; clearing off in the evening.
Wild geese.	A small flock of wild geese passed over station flying south. No aurora.
	Fair weather sunset. Verified.
	3d.
Heavy fog.	Easterly winds, with heavy fog in the morning; partly cloudy weather, clearing in the middle of the day, but clouding up again in the evening. Order "Up Signals" received at 5.40 p. m. Obscured.
Up Signals.	Foul weather sunset. Verified.
	4th.
Rain.	Easterly winds continued with increasing cloudiness and rain from 8.30 a. m. to 10.40 p. m. Amount of rain-fall 2.73 inches. The wind increased to 25 miles per hour at 7.45 p. m., and at 9.15 p. m. to 65 miles from the north-east, which blew in the north side of the instrument shelter, breaking maximum thermometer No. 217, minimum thermometer No. 246, and hygrometer-tube No. 9. Much damage done to property in the city, and, as the telegraph lines begin to be repaired, reports from the surrounding districts bring in long lists of disasters to property and shipping, and great loss of life by foundering and wreck of vessels. Reports from the Delaware breakwater show ten vessels missing that were anchored there when the storm commenced. Order "Hoist Off-shore Signals" received at 10.10 p. m. Obscured.
Storm.	Foul weather sunset. Verified.
Damage to instrument shelter.	
Instruments broken.	
Damage by gale.	
Off-shore Signals.	
	5th.
Down Signals.	Cold, brisk and high northerly to westerly winds, with clear weather in the evening. "Down Signals" received at 5 p. m. The display was fully justified; maximum velocity during display of Off-shore Signal was 38 miles from the northwest. Many favorable comments were made both by the press and parties interested in shipping and other interests affected by the weather.
Signals justified.	Broken maximum thermometer No. 217, minimum No. 246, and hygrometer-tube No. 9, forwarded to Office of the Chief Signal Officer by mail. No aurora.
	Fair weather sunset. Verified.
	6th.
	Northwest winds and clear cold weather, only a few clouds being visible during the entire day. No aurora.
	Fair weather sunset. One-fourth of the western sky tinged with yellow. Not verified.
Yellow sunset.	

Abstract of Daily Journal, &c.—Continued.

Floating ice.
Observations of
water temperature
suspended.
Snow.

Battery.

7th.

A large amount of floating ice in the river, causing delay in navigation; the edge of the river frozen so that observations of water temperature had to be suspended. Snow set in at 11.25 a. m. and continued until 4.30 p. m.; wind southeast with higher temperature.

Battery cells wiped with a damp cloth. No aurora.
Fair weather sunset. Verified.

8th.

Ice in river.
Aurora.

Clear, cold weather. Ice forming rapidly on the river. A brilliant aurora was visible from 7.15 p. m. until after midnight. It first appeared as a diffuse light of a pale straw color, changing to a pale green and then to a red; these colors blending and alternating until towards 10 p. m., when a beautiful auroral arch formed about 25 degrees above the northern horizon, and about 5 degrees in width, from which waving, shimmering beams of yellowish white light shot up toward the zenith, and across which the merry dancers flashed from side to side with inconceivable rapidity, and at the time of taking the midnight observation was still brilliant. This arch seemed to rest on a dark cloud or base which apparently remained stationary.
Fair weather sunset. Verified.

9th.

Polar bands.
Lunar halo.
Snow.

Aurora ended at 3.20 this a. m. Polar bands were observed at 5 p. m., covering about three-fourths of the sky from the southwest to the northeast; also a lunar halo from 8.30 to 9.50 p. m.; it was pale and not well defined. Snow began falling 11.45 p. m. Doubtful sunset. Obscured.

- 10th.

Snow.
Ice gorge.
Navigation closed.

Snow ended at 2.30 a. m. Ice gorged in the river a few miles above the station. Navigation closed by ice. The last vessel to depart was the steamer "Gladiator," with a cargo of miscellaneous merchandise.

Weather clear and cold. No aurora.
Fair weather sunset. One-fifth of the western sky colored with green.

Green sunset.

Verified.

11th.

Solar halo.
Mock suns.
Up Signals.

Between 10 a. m. and noon a clearly defined solar halo was visible, also a fine appearance of mock suns. Order "Up Signals" received at 12.38 p. m. Temperature increasing with wind backing to the southeast, and in the afternoon the sky became cloudy. Obscured.
Foul weather sunset. Verified.

Abstract of Daily Journal, &c.—Continued.

	12th.
Wind and snow.	Heavy wind and snow storm began at 6.15 a. m., and was very destructive; trees were blown down, some uprooted, and others broken off several feet above the ground; in several instances buildings were unroofed and some were shifted from their original positions. Cautionary Signals justified, maximum velocity 40 miles from the southeast. Order "Hoist Off-shore Signals" received at 5 p. m. At 10.45 p. m. the snow ceased and the wind shifted to the northwest, but it continued cloudy at the time of taking the last observation.
Damage by storm.	Obscured.
Signal justified.	Verified.
Off-shore signals.	Foul weather sunset.
	13th.
Gale.	Heavy gale from the northwest at 7.30 a. m., which attained a maximum velocity of 42 miles per hour at 9 a. m. NW. Cloudy and intensely cold weather. Order "Down Signals" received at 4.16 p. m. Signals justified. No casualties to shipping heard of, navigation being closed.
Down Signals. Signals justified as to velocity.	No aurora.
	Verified.
	14th.
Dense fog. Halo.	Higher temperature and southerly winds, with dense fog hanging over the river. A halo was observed at 9 p. m., of 22° radius, the inner edge being well defined and of a reddish color, while the outer edge was of a pale blue.
Battery.	Battery cells examined and wiped off. No aurora.
	Fair weather sunset. Not verified.
	15th.
Snow storm.	A heavy snow storm commenced at 8 a. m., and lasted until 4 p. m. Wind storm at 6 p. m., maximum velocity 30 miles per hour from the northwest at 8 p. m. No signals ordered.
Wind storm.	No damage resulted as far as heard from. No aurora.
No signals.	Fair weather sunset. Verified.
	16th.
	Weather clear throughout the day with but little wind. No aurora.
	Fair weather sunset. Not verified.
	17th.
Rain.	Much higher temperature, wind southeast; light rain in the afternoon, which continued through the night, freezing as it fell. Obscured.
	Foul weather sunset. Verified.
	18th.
Rain.	Light rain at intervals during the day, changing to light snow at night. Obscured.
Snow.	Foul weather sunset. Verified.

Abstract of Daily Journal, &c.—Continued.

	19th.
	Storm ceased before daylight this morning; higher temperature and clear weather. No aurora.
	Fair weather sunset. Not verified.
	20th.
Thaw.	Weather very warm, a general thaw is taking place.
Rain.	In the afternoon a heavy, warm rain occurred, accompanied by several distinct peals of thunder. Rain-fall .98 of an inch. No aurora.
Thunder.	Fair weather sunset. One-fourth western sky covered with yellow. Verified.
Yellow sunset.	
	21st.
Ice gorge.	The ice gorge above the city is momentarily threatening to break. Weather still warm; wind from the south.
Battery.	Battery examined and cells wiped off with a damp cloth. Obscured.
	Foul weather sunset. Not verified.
	22d.
Ice gorge gives away.	The ice gorge broke to-day, doing much damage to bridges, wharves, and shipping. The lower section of the river gauge was carried away, but the deficiency was supplied by the construction of a temporary gauge from a pine stick, which can be made to answer until the necessary repairs are made. Wind south and weather generally clear. A small lunar halo was formed between 11 and 12 p. m. No aurora.
River gauge.	Fair weather sunset. Verified.
Lunar halo.	
	23d.
Halo.	Partly cloudy during the day; a faint halo was observed at 9 p. m.; clear sky, and stars unusually brilliant and twinkling. No aurora.
Stars.	Foul weather sunset. Verified.
	24th.
Up Signals.	"Up Signals" received at 1.05 a. m.; morning opened cloudy; rain commenced at 12.35 p. m. and continued, at intervals, until 9 p. m., when it turned to sleet.
Rain.	Obscured.
Sleet.	Foul weather sunset. Verified.
	25th.
Rainy and stormy.	Rainy and stormy up to 3.20 p. m., and cloudy until 11.30 p. m. Order "Signals down" received at 9.40 p. m., signal justified. Maximum velocity of wind during the display was 28 miles per hour from the south at 4 p. m. No vessel left port during the display. No disasters heard from. Obscured.
Signals down.	Foul weather sunset. Not verified.
Signals justified.	

Abstract of Daily Journal, &c.—Continued.

	26th.
River clear of ice	Clear weather and mild temperature; no ice in the river; observations of water temperature resumed. Changed position of barometer at 1 p. m., as per instructions from Office of the Chief Signal Officer, dated December 23, 1880, making elevation of barometer above sea-level 121 feet; commenced correcting for this elevation with the 2 p. m. observation. Navigation opened. The first vessel to arrive was the schooner "Kin ; Philip," with a cargo of merchandise. No aurora. Fair weather sunset. Verified.
Water temperature observations resumed.	
Removal of barometer.	
Navigation open.	
	27th.
Off-shore Signals.	Order "Hoist Off-shore Signals" received at 12.55 a. m.; wind northwest in the afternoon. Extraordinary fall of temperature at night; weather clear. No aurora. Fair weather sunset. Verified.
	28th.
Signals down.	Order "Signal down" received at 10.30 a. m.; the signal was justified as to direction but not as to velocity; maximum velocity during the display 24 miles NW. Weather moderating, clear in the morning and cloudy in the afternoon and evening. Battery cleaned and two imperfect cells removed and repaired. Obscured. Foul weather sunset. Verified.
Signal justified as to direction.	
	29th.
Rain.	Light rain in the morning, changing to light snow in the afternoon, and ending at 4.15 p. m. No aurora. Fair weather sunset. One-third western sky covered with yellow. Verified.
Snow.	
Yellow sunset.	
	30th.
	Fair weather; the sky partly covered with cirrus and cirro-cumulus clouds during the entire day.
Private Williamson.	Private Wm. H. Williamson relieved from duty by Private Thomas Edwards, in accordance with Special Order No. 95, dated Office of the Chief Signal Officer, Washington, D. C., December 26, 1880.
Private Edwards.	
Water thermometer broken.	Water thermometer, No. 166, was accidentally broken this afternoon, while taking temperature of water in the river, by becoming entangled in some old logs at the bottom. No aurora.
Green sunset.	Fair weather sunset. One-eighth of the western sky colored with green. Verified.
	31st.
Removal of office.	Clear. Office moved this morning between 8 and 11 o'clock, from No. 252 Second street to No. 354 Fourth

*Abstract of Daily Journal, &c.—Continued.*Thermometers
tested.

street, by authority from the Office of the Chief Signal Officer, dated December 20, 1880. A report of instruments and their positions, with a description and plan of the office, this day transmitted by mail to the Office of the Chief Signal Officer.

All the thermometers in use at this station were tested to-day and read as follows:

Standard thermometer No. 269	.....	32°
Extra " " 148	.....	31°·8
Maximum " " 143	.....	31°.
Minimum " " 215	.....	32°
Dry-bulb " " 20	.....	31°·5
Wet " " 69	.....	32°
Dry " " 59	.....	32°

Comparative barom-
eter readings not
taken.

No comparative barometer readings were taken, there being no extra barometer at this station. No aurora. Fair weather sunset. Verified.

Cautionary Signals.

3rd.	N. E. 65 miles.	Justified.	See abstract.
11th.	S. E. 40 "	Justified.	See abstract.
24th.	S. 28 "	Justified.	No disasters.

Cautionary Off-shore (or Northwest) Signals.

4th.	N. W. 38 miles.	Justified.	See abstract.
12th.	N. E. 42 "	{ Justified as to velocity only.	No casualties.
27th.	N. W. 24 "	{ Justified as to direction only.	No results known.

Storms for which Signals were not ordered.

15th.	N. W. 30 miles.	No damage as far as heard from.
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River.

Highest water 25 feet December 22d.
Lowest " 8 " 1 inch... " 8th and 9th.
Range 16 feet 11 inches.

SUMMARY OF SUNSET PREDICTIONS.

Character of pre- diction.	No. of pre- dictions.	No. veri- fied.	No. not verified.	No. of sunset observa- tions not taken.
Fair ... { Red	13	10	3	.....
{ Yellow ..	3	2	1	0
{ Green ..	2	2	0	.....
Foul	12	10	2	0
Doubtful	1	.....	.....	.....
Total	31	24	6	0

Abstract of Daily Journal, &c.—Continued.

CONDITION OF INSTRUMENTS.

		Corrections for instrumental error.	
Barometer.....	154	+ 0. 004	Serviceable.
Thermometer, exposed	269		do
do . exp'd extra.....	148		do
			do { 1° to be added to each reading to correct for instru- mental error, as per instructions from O. C. S. O., dated July 6, 1878.
do maximum	143	— 0. 2°	do
do do extra.....			do
do minimum	215		do
do do extra.....			do
do wet bulb.....	59 & 69		do
do do extra.....			{ Broken while taking temperature of river on the 30th.
do water.....	166		Serviceable.
do do extra.....			do
do water-case	83		{ Arms bent, cups loose and out of shape; can be repaired for 75 cents.
Anemometer.....	130		Serviceable.
do	84		do
Self-register for anemometer ..	90		do
do do do	21		do
Anemoscope			do
Rain-gauge.....			{ Lower section carried away; can be repaired for \$5.
River-gauge			

Sergeant, Signal Corps, U. S. A.

NOTE.—All marginal notes must be made in red ink.

144. The Record of Bulletins, when its use is authorized at any station, will be filled up regularly from the daily bulletins, of which it is a copy.

On stations where the telegraphic reports received do not exceed nine in number, a whole page of the Bulletin Book will *not* be used in entering each bulletin. To economize space, the reports will be entered in alphabetical order, but the record of as many days will be written upon each double page as the space will allow, each day's record being distinguished by its proper date, and separated from the preceding one by a red-ink line.

Whenever necessary, the printed names of stations will be ruled out, and those from which reports are received, written with red ink in the blank spaces between the original names, and in regular order.

145. All letters sent, and an abstract of those received relating to official business of the station, will be entered in the books of Letters Sent and Letters Received. The original letters received will be properly briefed and numbered, and (excepting those to be forwarded) filed away for reference.

LETTERS RECEIVED.

146. In the book of "Letters Received" will be entered a record of all official letters and telegrams received at the station.

All communications on letter-paper will be folded in three equal folds, parallel with the ruling, and if written on other than letter paper, will be folded so as to conform to that size. All communications will be entered in the order of their receipt, and numbered continuously, beginning at one (1) on January 1st of each year (or at the date of the receipt of the first letter, when a station is opened during the year), and each letter will be known by this number in all references made to it in the office records. Inclosures to letters will not be indorsed, but simply numbered in red ink as "Inclosure No. —" to said letter. On the top of the first fold will be entered in RED ink the number of the letter, the name of the station, and the current year. This will be followed by the following entries in BLACK ink:

1st. The place where written, and date.

2d. The official designation of writer or department or office from which it is written or the name of writer.

3d. A brief synopsis showing the general purport of the letter. In this synopsis, or *brief*, everything of importance to the indexing of the letter will be concisely stated.

Following this will be given in RED ink the number of inclosures, if any, in the letter, and such references as may be necessary to show where other letters connected with it can be found in the records. At the bottom, also in red ink, the date on which the communication is received will be entered (see examples A and B, which follow). If the communication is received by telegraph, the word "Telegram" will be written in red ink immediately below the brief.

The following illustrations show the manner of entering letters in the record:

When received.	Name of writer.	Date; purport of letter.
April 17, 1881. *90.	Chief Signal Officer, by Lieut. Robt. Craig, P. & D. O.	Washington, April 12, 1881. Take up one stylus dropped from return for 1st April and correct retained copy.
* Retained	return corrected April 17,	1881.

When received.	Name of writer.	Date; purport of letter.
April 19, 1881. *94.	Chief Signal Officer, by Lieut. W. E. Birkhimer. *[One inclosure.]	Washington, April 12, 1881. Furnish manifold bulletin daily to James R. Stone, Racine, Wis., as requested by Louis Decker.
* Delivery of bulletin	commenced April 20, 1881.	See L. S., Vol. 1, page 59.

* Red ink.

In briefing letters "received," care should be taken to bring into the brief all names, places, and principal nouns used in the letter, so as to insure the indexing of every proper key-word to the letter.

One or more lines will always be left below the brief in the record for noting, as shown in the illustrations, any action taken in consequence of said letter, as well as the entry-marks of any letters, either received or sent, especially connected with it.

In these references letters *received* are referred to by number and year, and letters *sent* by volume and page.

In case the letter received is to be returned or forwarded with an indorsement, such indorsement will be entered in full in the book of "Letters Received," in the space immediately below the brief, and two additional lines will then be left in which to note any future action.

Indorsements should never be placed on the first fold (which is the fold at the top of the sheet) as that is always reserved for briefing, and noting subsequent action, the date of receipt of different offices and other memoranda; but in forwarding communications received by them, observers will commence their indorsement near the top of the second fold, the top being the left side of the sheet when opened.

LETTERS SENT.

147. In the book of "Letters Sent" will be entered all communications sent out either by letter or telegram, excepting only such indorsements as are entered in "Letters Received," in accordance with the instructions contained in the preceding paragraph. All proper names appearing in the body of the letter will be underlined with red ink. In the margin will be given in red ink the entry-marks of any letter either received or sent in connection therewith; "Letters Received" being referred to by number and year, "Letters Sent" by volume and page. Exact copies of all telegrams sent will be entered in full, and marked "Telegram" in red ink. The following illustrations of the mode of entering "Letters Sent" will show the manner in which the several notes are made:

"LETTERS SENT."

*59.

* L. R. 94.

MILWAUKEE, Wis., May 3, 1881.

* Milwaukee,

To the Chief Signal Officer of the Army:

* 1881.

SIR: I have the honor to advise you that I am verbally informed by Mr. Louis Decker that J. R. Stone, of Racine, Wis., has removed to Oregon, and that in consequence I have this day discontinued the manifold bulletin ordered by communication from your Office under date of April 12, 1881.

Very respectfully,
Your obedient servant.

S. W. RHODE,
Sergeant Signal Corps, U. S. Army.

NOTE.—In case any other letters had passed in this connection the entry-mark should be entered in the margin.

* Red ink.

INDEXING.

148. The alphabetical indices in the letter books will be kept up regularly from day to day, and must show the names in proper order of all official correspondents of the observer, with references to volume and page where their communications appear.

In "Letters Received," each proper name will be followed by the number of the letter in which it is to be found. The names will always be written in black ink, but the numbers, if the letter is to be indexed in the writer's name, will be entered in black ink; otherwise, in red ink.

In "Letters Sent," the proper names will be followed by the number of the page on which the letter containing the name is to be found; if it is the name of the person to whom the letter is written, it will be entered in black ink; otherwise, in red ink. Each name will be entered but once, and the numbers will follow it, successively, as follows:

Signal Officer, Chief, 1, 3, 4, 8, 10, &c.

Wind-vane, 3, 10, 29.

Wentworth, H. W., 18, 24, 26.

149. The following names and subjects must be indexed in the examples of Letters Received and Sent, given in the preceding paragraphs, assuming that the letter sent is entered on page 25 of the Letter-Book.

"LETTERS RECEIVED."

Chief Signal Officer,	90. 94.	(under the letter S.)
Craig, Robt., (Lieut.)	90.	(under the letter C.)
Stylus, relating to	*90.	(under the letter S.)
Birkhimer, W. E. (Lieut.)	94.	(under the letter B.)
Manifold bulletin, relating to	*94.	(under the letter B.)
Stone, James R.	*94.	(under the letter S.)

"LETTERS SENT."

Chief Signal Officer,	25.	(under the letter S.)
Decker, Louis	*25.	(under the letter D.)
Stone, J. R.	*25.	(under the letter S.)
Racine, Wisconsin,	*25.	(under the letter R.)
Manifold bulletin, discontinued	*25.	(under the letter B.)

All *names* and *words* must be written in *black* ink, and in these examples all *figures* except such as are asterisked, which must be written in *red* ink.

150. General Orders, Special Orders, and Circulars will be filed away separately, and in such manner that they can be found readily, and will be cheaply bound by the observer at the end of each year. General Orders and Circulars will be indorsed in red ink at the bottom of the first page with the name of station and date of receipt as follows:

Received, (Milwaukee,) ———, 188 ."

* Red ink.

151. The following examples illustrate the manner of briefing Letters Received and the treatment of inclosures :

EXAMPLE "A."

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE,
Washington, D. C., April 12, 1881.

Sergeant S. W. RHODE,
Signal Corps, U. S. A., Milwaukee, Wis. :

SERGEANT: Inclosed herewith is a copy of a letter from Mr. Louis Decker, requesting that a weather-map be furnished daily to Mr. James R. Stone, Racine, Wisconsin, to be displayed for the benefit of the public. You will place Mr. Stone's name upon your list, and comply with his request.

Very respectfully, &c.,

W. E. BIRKHIMER,
*First Lieutenant, Third Artillery,
Acting Signal Officer.*

*94. Milwaukee, 1881.
Washington, April 12, 1881.
Chief Signal Officer, by Lieut. W. E. Birkhimer,
Furnish manifold bulletin daily to Mr. J. R. Stone, Racine, Wisconsin, as requested by Mr. Louis Decker.
*[One inclosure.] * See L. S., Volume 1, Page 59.
*Received, Milwaukee, April 19, 1881.

Explanation.—All office-marks in red ink ; brief in black ink. "L. S., Vol. 1, page 59," refers to letter subsequently written in regard to this bulletin.

*Red ink.

INSTRUCTIONS TO OBSERVERS

Inclosure to Example A.

(Copy.)

MILWAUKEE, WIS., *April 9th*, 1881.

To the CHIEF SIGNAL OFFICER OF THE ARMY:

SIR: I have the honor to request that the sergeant in charge of the station in this city be directed to furnish a manifold bulletin, daily, to Mr. James R. Stone, Racine, Wisconsin, to be displayed for the benefit of the public.

Respectfully, yours,

LOUIS DECKER.

* 94. Milwaukee, 1881.

* Inclosure No. 1.

EXAMPLE "B."

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE,
Washington, D. C., April 12th, 1881.

Sergeant S. W. RHODE,
Signal Corps, U. S. A., Milwaukee, Wis.:

SERGEANT: I am directed to inform you that one stylus dropped by you from your property-return for 1st quarter, 1881, must be taken up

* Red ink.

until inspected and condemned by proper authority. You will make the necessary correction in the retained property-return for that quarter.

Very respectfully,

ROBT. CRAIG,
First Lieutenant, Fourth Artillery, P. & D. O.

* 90. Milwaukee, 1881.

Washington, April 12th, 1881.

Chief Signal Officer,
by
Lieut. Robt. Craig,
P. & D. O.

Take up one stylus dropped from return for 1st quarter, 1881, and correct retained copy.

* Received, Milwaukee, April 17th, 1881.

152. The books "Letters Sent" and "Letters Received," kept at stations of the Signal Service, are official records and will only be open to the inspection of the *officers* of the Signal Service and the *enlisted men* on duty at the station to which the records belong.

Letters transmitting checks for pay, &c., of observers and assistants, must be carefully entered in the book of "Letters Received," and then delivered to the person to whom they are addressed, with note of the date of such delivery. Enlisted men receiving such letters will fill up and sign the receipt attached thereto and return to this Office. Great care should be taken to specify the amount of each bill forwarded in any letter, with date upon which each item was contracted, and also to note in the Letter-Book the date of all payments under the brief of the letter containing the remittance.

Letters of transmittal are not required and should not be forwarded with meteorological forms.

153. Communications to this Office on official business will be written on the official size of letter-paper, inclosed in an official envelope, and directed to "The Chief Signal Officer of the Army, Washington, D. C.," and not to individual officers in charge of the several office divisions. The words "Official Business," when not printed, will be written on the left-hand upper corner of the envelope.

154. Half sheets of paper will be used in all cases in which letters are completed on the first page. *When more than one page is required a whole sheet will be used.*

* Red ink.

155. Communications written on letter-paper will be folded in three equal folds, and on foolscap or legal cap paper in four equal folds, parallel with the ruling. Observers must not brief their official letters to this Office, and must give the full names of all persons referred to.

156. Enlisted men will not embody in the same communication matters relating to different subjects, nor their meteorological observations and general details of duty with those relating to property received or disposed of, commutation or pay vouchers, bills, or any other particular involving money or property accountability.

Letters of transmittal, application, or explanation, under these two general heads, must be written on separate sheets of paper, but will be sent in the same envelope as a matter of economy. All communications should combine fullness with brevity, in language significant yet without embellishment, with ample reference to what has preceded, yet without needless repetition, dignified yet simple, and, as far as possible, they should be written in the *third* person.

157. Enlisted men of the Signal Corps, in signing official communications to this Office, or elsewhere, and in signing bulletins, or other official publications, must always give their full name and after that their actual military rank.

158. All official communications received by observers, wherever serving, whether from parties connected with the Signal Service or not, will be immediately forwarded to this Office for such action as may be considered necessary.

Observers in reporting errors made at their stations will always give the name of the enlisted man making them.

159. No reports or letters containing information in reference to the Signal Service, or any of its duties, will be made or sent to any person or persons by enlisted men of the Signal Corps until such reports or letters have been submitted to and approved by the Chief Signal Officer.

160. In returning communications to this Office, which have been referred "for report" or "remark," the report or remarks will be written in the form of an endorsement on the original communication. Whenever this is impracticable for want of room, a separate sheet of paper will be attached to the back of the fold of the last indorsement, which sheet will be made of the same size as the previous folds and contain as many leaves as may be necessary for the report.

Whenever reports are made upon papers referred by indorsement, of such length that they fill several pages of letter or cap paper, the reports will be written in the form of letters, and the paper referred will be indorsed "Respectfully returned to the Chief Signal Officer with report called for inclosed." This report will be properly dated and signed.

161. All communications to this Office from an assistant observer must be forwarded through and indorsed by the observer in charge of the station at which he is serving.

In acknowledging the receipt of communications from this Office, enlisted men must clearly state the nature of the contents of the communication to which they reply, so that it will not be necessary to look up the subject thereof in the records of this Office.

All written communications, such as reports on the verification of storm signals, &c., between this Office and any station of the Service, are confidential and will not be made public without authority from this Office.

162. The "Monthly River Record" will be furnished to all stations at which river observations and reports are regularly made.

This book is intended for official use and reference on station, and in it will be entered, daily and carefully, the data called for by the headings of the several columns.

Care must be taken to keep the book clean and free from blots and erasures.

Every expenditure and purchase must be promptly and accurately noted, when incurred, in the "Expense Book" prescribed by this Office, to be kept at each station, in the column under the proper head printed therein. Where a bill contains more than one item of expenditure or purchase, each item must be separately entered, with its cost noted under the head of remarks.

163. All books of reference and record must have the *name* of the station to which they belong plainly written on the fly-leaf.

MEDICAL TREATMENT.

164. In case of sickness or disability rendering an observer or assistant observer incapable of performing his duties, and it is believed that such disability will continue for a period of ten days or more, the observer in charge will report the fact by telegraph to the Chief Signal Officer, and will forward by mail the certificate of the attending physician as to the nature of illness and probable duration. If the work of the station can be performed without additional assistance, this fact will be stated in the telegram announcing such illness.

165. At stations where there is no medical officer, a resident practitioner will be employed, whose account, made out in duplicate, on the form given below, together with duplicate copies of the prescriptions when medicines have been required, for which a separate charge is made, will be forwarded by the observer in charge of the station, inclosed in a letter of transmittal, addressed to the Chief Signal Officer of the Army, which will contain an express statement as to the correctness of the amount, and any explanation or criticism proper to a full understanding, for its transmittal to the Surgeon-General of the Army.

THE UNITED STATES,

To _____, M. D., Dr.

For medical attendance furnished to _____, Signal Corps,

U. S. A., suffering from _____ at _____ from _____ to _____;

(No. of visits _____) \$ _____

For medicines, as per accompanying prescriptions _____

I certify that the above account is correct and just; that the services were rendered as stated, and were necessary; and that the charges do not exceed those customary at this place.

_____, M. D.

Sworn to and subscribed before me, this _____ day of _____, 188—.

_____,
_____.

I certify that the above account is correct and just; that the services were rendered as stated, and were necessary; that I was on duty at _____, and could not secure attendance from a medical officer of the Army.

_____,
Sergeant (or Private) Signal Corps, U. S. Army.

Sworn to and subscribed before me, this _____ day of _____, 188—.

_____,
_____.

Approved: _____

_____,
Brig. & Bvt. Maj. Gen., Chief Signal Officer U. S. Army.

The oath and subscription should, if possible, be taken before a notary public, who should affix his official seal. If he has no seal, the certificate under seal of the Secretary of State, of the State appointing the notary, is required, stating that he was such notary at the date of the subscription. If the subscription be before a justice of the peace, or other magistrate not having an official seal, the certificate of a clerk of a court of record, with the seal of the court, that he was such justice, &c., is required.

The date when medical services were rendered should be carefully stated in all accounts, and no account must embrace parts of different fiscal years. An account which runs through a period both prior and subsequent to June 30 must be separated into two distinct accounts; the one closing with June 30, and the other commencing with July 1 in any year.

166. The fee that a notary or magistrate may charge for administering and certifying to the oath and subscription required by the above form cannot be made a subject of specific claim for reimbursement, and will not be included as an item of the account. The observer in charge of each station will keep on hand a sufficient supply of the above form of account in print, which he will procure from this Office by the usual mode of requisition.

167. No account of a physician at any station where a medical officer of the Army is on duty can be paid, unless it shall clearly appear that the assistance of the medical officer could not be obtained in the special case. Should the medical officer be temporarily inaccessible, upon the occurrence of a case so sudden and serious as to require immediate attention, he will nevertheless be called upon as soon as possible, and his certificate that the case required another practitioner to be employed under the circumstances will be necessary before the account of the latter can be paid.

168. An enlisted man obtaining medical assistance or medicines from other sources than a medical officer of the Army, when the latter can be called upon, will be personally responsible for the account therefor, such not being authorized by the United States.

169. Bills for articles of food, or diet of any kind, liquors, wines, mineral waters, patent or proprietary medicines, instruments or appliances, such as syringes, trusses, or suspensory bandages, will not be allowed by the medical department. Bills for expensive surgical operations will not be approved unless authority to contract them has first been obtained from this Office.

170. When the services of a nurse are necessary, a separate account for the nursing will be made and certified in the same manner as that for medical attendance. The account may be made out in either the name of the nurse or medical practitioner, in accordance with the person to whom the payment is to be made, but the sworn certificate must, in all cases, be made by the medical practitioner. The account of an apothecary other than the physician should, when possible, be included in the account of the latter "for medicines, as per accompanying prescriptions," and must be accompanied, in addition to the prescriptions, by a receipt of the apothecary to the physician for the amount of the charge for medicines furnished. This receipt need not be in duplicate nor sworn to, an ordinary receipted bill being sufficient. When the account is necessarily separate, it may be made out in the name of the apothecary, in the above form, but the sworn certificate must be made by the physician.

171. At stations where there is a medical officer of the Army on duty, observers will be duly notified, and provided with authority to call upon

him for medical assistance. When medicines are not furnished directly by the medical department, but through an apothecary, on the prescription of a medical officer, and the bill of the apothecary is presented to the patient, that bill, in duplicate, approved by the medical officer and receipted, will be attached to an account made out in the name of the patient, the above form being altered according to the facts, and the only sworn certificate necessary being that of the patient.

172. None of the accounts above alluded to—of physicians for attendance, of a nurse for services, or of apothecaries for medicines furnished—will embrace charges to include time both before and after the 30th of June, in any year, that day being the end of the fiscal year of the United States. The law requires payments to be made out of different appropriations in such cases, and the accounts for any charges in any one fiscal year must be separate from those in any other year; otherwise they will invariably be returned for separation of items in new accounts.

DECEASED SOLDIERS.

173. (1.) On the death of an enlisted man of the Signal Corps, U. S. Army, the fact will be immediately telegraphed to this Office, giving the time and place.

(2.) In the absence of relatives, the necessary arrangements will be made for burial, the expenses of which must not exceed (including burial site and opening of the grave) fifty dollars (\$50). If relatives or other friends are present and insist upon a more expensive funeral, they and the undertaker will be informed that no expense incurred in excess of the above amount will be settled by the government. Funeral expenses should all be included in an itemized bill of the undertaker, which will be forwarded to this Office with a letter of transmittal.

(3.) An inventory of the effects of the deceased will be taken in duplicate, and forwarded to this Office in accordance with the following form:

"Inventory of the effects of _____, late a _____ Signal Corps, United States Army, who died at _____ (place), at _____ (hour) on the _____ day of _____, 18____, by reason of _____ (disease)."

(Here will be inserted a list of the articles, including any money (specie or notes) which may be found among the effects of the deceased, and which will also be forwarded with the inventory to this Office.) (The following certificate will be given below the list of articles:)

I certify that the above inventory comprises all the effects of _____, Signal Corps, U. S. A., deceased, and that the effects are stored in the Signal Office at _____, (or were turned over to _____, the legal representative of the deceased, as the case may be.)

(Signed) _____,

Sergeant (or Private) Signal Corps, U. S. A.

Place: _____

Date: _____

In case the effects are turned over to the legal representative, the following certificate will be given under the inventory:

I certify that I am the legal representative of _____, late _____ Signal Corps, U. S. A., and that I have this day received from _____, Signal Corps, U. S. A., the above effects.

(Signed) _____,

Sworn to and subscribed before me this _____ day of _____, 18____.

_____,
_____.

(This certificate to be sworn to before a justice of the peace, a notary public, or a commissioned officer, at the expense of the party subscribing to the certificate.)

(4.) Immediately after the funeral a certificate of the attending surgeon will be forwarded to this Office, giving cause and date of death; also a certificate of the undertaker or superintendent of cemetery in which deceased may be interred, giving date of burial, and location and number of the grave.

THE COAST SIGNAL SERVICE—GENERAL DUTIES.

174. Officers and enlisted men, and others of the Signal Service, employed upon the sea-coast service at light-houses, life-saving stations, or other points of observation, are charged with the following duties:

1st. To make directly to the Chief Signal Officer, for information of the War, Treasury, or Navy Departments, reports of all occurrences that come within their field of observation of important interest to any service of the United States.

2d. To report especially all meteoric changes and indications of approaching storms.

3d. To display, note, and exchange all necessary signals.

4th. To maintain necessary official communication along the coasts between the different services and between the different coasts and this Office.

175. To enable the officers or enlisted men and employes of the Signal Service to render with sufficient promptness the reports of information required of them, the officers and employes of other services are requested to report to them with the least delay all important occurrences coming within the scope of the coast service.

In addition to the usual report on Form 203, enlisted men in charge of stations on the Signal Service coast telegraph line will send to this Office with each telegraphic report the maximum velocity of the wind since the preceding telegraphic observation, and, with the afternoon reports, the reading of the maximum thermometer. In enciphering the reports on Form 203, a velocity cipher-word from the column beginning with the letter I will be used to express the maximum velocity, and for maximum temperature, the thermometer words found on page 32 of the cipher-book. The maximum velocity word will be written on Form 203, immediately after the regular velocity word, and in the afternoon report the maximum temperature word after the rain-fall. These special observations will be recorded in the Original Record of Observations.

Care must be taken not to disturb the mercury in the tube of the maximum thermometer when taking this reading, as so doing would destroy the accuracy of the reading of that instrument taken at the 11 p. m. (Washington time) observation.

176.

STATION CALLS.

Sandy Hook	H	Cape Henry	C
Barnegat	Di	Life-saving Station No. 6	B O
Little Egg Harbor	J	Kitty Hawk	G
Atlantic City	A	Cape Hatteras	D
Cape May	F	Portsmouth	C S
Del. Breakwater	B	Cape Lookout	Q
Ocean City	V	Fort Macon	U S
Chincoteague	In	New River	R N
Philadelphia	Ch	Sloop Point	K
Baltimore	Br	Wilmington	Wi
Chief Signal Office	S O	Smithville	S V
Norfolk	X		

177.

SPECIAL SIGNALS.

1. Wait a minute.
 4. Start me.
 7. Are you ready?
 8. Busy on the other wire.
 9. Test.
 13. Do you understand?
 18. What is the trouble?
 27. Adjust your magnet.
 134. Who is writing?
- Operators must in all cases give way for the Signal 9.

178.

TELEGRAPHIC REGULATIONS.

1. Each operator will have a private signal (generally the initial letter of his name), which must be given after the "O. K." to all telegrams received or sent.

2. Before opening the circuit, each operator must carefully adjust his relay, and be certain that no other person is using the line; *this rule must be strictly complied with.*

3. All calls must be answered promptly.

4. The order in which the several stations shall occupy the wire for the transmission of reports and other business will be indicated by the officer in charge at this Office.

Struggling for the circuit will not be permitted. Each man must take his regular turn in sending reports. Absence from duty, without special permission from this Office, will not be permitted.

5. An operator will be on duty daily at each station from 7 a. m. until receipt of "good-night" from this Office. At stations where the sergeant has an assistant, the hours of duty will be equally divided between himself and assistant, and so arranged that the night-work shall be done alternately. Hours for meals must be so arranged that one operator will be left on duty.

6. Messages for transmission must be written on Telegraph Form No. 201.

7. The date and time at which a message is received for transmission must, in all cases, be plainly written by the receiver upon the margin of the message.

8. The following rules must be observed in counting words in all messages:

All words will be counted except the *date* and *place* at which the message is filed.

Names of cities and places, when used to designate such cities or places, will be counted as one word; for example: New Orleans; New York; West Troy.

Words connected by a hyphen, as found in Webster's Dictionary, will be counted as one word; examples: To-day; rail-road; head-quarters; aid-de-tamp.

Names of persons and places, when given to things, must be counted according to the number of distinct words in each; examples, names of steamers: "Isaac Newton," two words; "Maid of the Mist," four words.

Names of hotels: "Burnett House," two words; "United States Hotel," three words.

When there are prefixes to surnames, such as Van, Mac, or Mc, Saint or St., &c., the whole name will be counted as one word.

9. Every message sent by telegraph must be checked at the end with the number of words it contains.

10. The receiving operator will count the number of words in each message received, and assure himself that it agrees with the check of the sending operator before giving his "O. K."

11. Messages may be shown to the senders or receivers upon personal application, or to a third person, upon their written order, and they may be allowed to make copies of the messages; but, in all cases, the sender or receiver, or the signature to the order, must be known or fully identified by the operator.

12. Care must be taken in preserving and filing away messages which have been transmitted, in order to make reference thereto easy and expeditious.

13. The sergeants in charge of terminal stations will be held responsible for the good condition of their batteries, which must never be wholly taken down, but cleaned and renewed by sections.

14. All messages must be transmitted precisely as they are received. No abbreviations will be used.

15. Operators will use extra caution in the transmission of proper names. The names must be written slowly, and double the usual space made between the initials.

16. In working with inexperienced operators, the words must be written slowly and plainly, and the sender assured that the message is understood.

17. When calling a station, the operator calling will sign the office-signal at short intervals.

18. When leaving the office temporarily, or for the night, the main line will be cut off from the instrument. This, however, must never be done without examining the switch or cut-off, to be sure that the circuit is complete through it.

19. The ground-wire, at intermediate offices, must never be used, except in cases of breaks in the wire, and then only long enough to enable an office to do the business in hand, after which it must be instantly removed.

20. The lightning-arresters must be kept clean and free from dirt or moisture, and must invariably be taken apart and examined after a thunder-storm.

The ground-plate must make perfect earth-connection, and be buried deep, in wet soil, beneath the reach of frost.

21. A copy of each message received and the original of all messages sent must be kept and forwarded weekly to this Office with Form 211.

Stations relaying messages will make copies and forward them to this Office with Form 211.

22. A receipt must be obtained for every message delivered, which will be kept for future reference, and the time of delivery noted thereon. Proper receipt-books will be furnished by this Office.

23. A careful estimate of articles required for the succeeding half year must be made and forwarded with the report for the last month in the half year for which the office has been supplied.

24. All instruments, relays, keys, switches, or parts of the same, refuse zinc or copper from batteries, and other property not in use, must be reported at the time of making requisition for supplies, stating number, kind, quantity, and condition of each.

25. Information will in no case be given to persons not clearly entitled to receive it concerning any message passed or designed to pass, over the wires.

26. The enlisted men and employés of the Signal Corps are prohibited from giving copies of messages or written statements relating thereto without authority from this Office.

27. A weekly report will be made, on the proper form, by the observer in charge of each station, of the amount and nature of repairs on his section of the line and amount expended for same.

28. For purpose of repairs, the coast-lines are divided into the following sections, and the sergeant in charge of the station named opposite each section will be responsible for the proper maintenance of the line on that section.

REPAIR-SECTIONS.

Station.	Section of repair.
Sandy Hook.....	From Sandy Hook to within ten miles of Barnegat Inlet.
Barnegat.....	From Barnegat to ten miles north of Inlet and south to Beach Haven.
Little Egg Harbor.....	From Beach Haven to Chestnut Neck on the south.
Atlantic City.....	From Chestnut Neck to Great Egg Harbor.
Cape May.....	From Great Egg Harbor to Cape May Point.
Delaware Breakwater.....	From the Breakwater to Indian River Inlet.
Ocean City.....	From Indian River Inlet to Green Run.
Chincoteague.....	From Green Run to Chincoteague Inlet.
Norfolk.....	From Norfolk to north side of Lynn Haven Bay.
Cape Henry.....	From south side of Lynn Haven to No. 3 Life-saving Station.
Life-saving S. No. 6.....	From No. 3 Life-saving Station to one-half way to Kitty Hawk.
Kitty Hawk.....	From one-half way to Life-saving Station No. 5 to north side New Inlet.
Cape Hatteras.....	From south side New Inlet to Hatteras Inlet.
Portsmouth.....	From Drum Inlet, north side, to south side of Hatteras Inlet.
Lookout.....	From north side of Drum Inlet to north side of Old Topsail Inlet.
Fort Macon.....	From south side of Old Topsail Inlet to the north side of Bear Inlet (25 miles)
New River.....	From south side of Bear Inlet to New River (21 miles).
Sloop Point.....	From south side of swamp south of New River to Scott's Hill.
Wilmington.....	From Scott's Hill to a point one-third of the distance to Smithville.
Smithville.....	From a point two-thirds of the distance to Wilmington to Smithville.

29. Repair-men, when sent out on duty, must take with them a pocket-relay or box-sounder, and, upon finding trouble, report the fact to their respective stations. If a repair-man has gone over his section without finding trouble, he must at once test the line, and, if trouble still appears, he must push on until he meets the opposite repair-man, or until the trouble is found, repaired, and the fact reported. All necessary repairs must be thoroughly made, and with as little delay as practicable.

GENERAL INSTRUCTIONS.

179. The observers, in making the regular meteorological observations at the sea-coast stations, will always note the character of the ocean-swell and the direction from which it comes, and will add the same to their telegraphic reports, using the words "*Heavy*," "*Long*," "*Short*," and "*Light*," as the case may be. When the direction from which the swell is moving is the same as that of the surface-wind given in the body of the report, it will not be sent by telegraph, but will be recorded in the usual manner; but when it varies from this, the direction will be given at each telegraphic report. Great care must be taken in making and reporting these observations, and the usual record of them will be made in the Original Record of Observations and on Form 113 A, for file in this Office.

180. The coast stations of the Signal Service will be furnished with, and will keep for purposes of reference, the United States official lists of vessels, as prepared at the Treasury Department, and, so far as possible, the official government vessel lists of other governments.

181. In case of accident to any vessel, the name, number, or distin-

guishing marks, any of which are known, will be reported. The station reporting a disaster will, so far as practicable, refer to her description in some government list.

182. A general report will be made by telegraph, daily, at 6 p. m., to the Chief Signal Officer, by the observer in charge of each sea-coast station, unless he is otherwise instructed. This report will contain—

First. A statement of the number of vessels of each class noted by the observer as passing within sight of the station during the preceding twenty-four hours, with the direction in which they were going.

Second. Names of vessels with which communication has been held during the day, and the name of code used.

Third. Number of wrecks or other marine disasters, with name of vessels; number of crew, number saved, nature of cargo, and condition at time of report, and such other specific information as may be necessary for the full information of the Departments at Washington.

Fourth. All unusual occurrences affecting the interests of the United States or the duties of the Navy, Treasury, or War Departments, with sources of information.

Fifth. All unusual atmospheric phenomena.

183. All shipwrecks or other disasters occurring, or about to occur, must be promptly reported to this Office, that information may be given to the proper authorities at the neighboring cities, ports, and other places, to the end that assistance may, if necessary, be called for.

All reports of this nature must be addressed to the Chief Signal Officer, who is charged with the proper communication of the intelligence to the Departments, and they must be authenticated by the signature of the observer in charge. Necessary messages from captains, crews, or passengers of vessels in distress, or official messages from any member of the military, revenue, the naval, light-house, or life-saving services will be sent in like manner to this Office, whence they will be forwarded to the proper address.

184. When there are charges beyond this Office, security must be given for the necessary payment, or it must be explicitly stated that the sender is not able to pay and cannot secure payment. This Office will be the sole judge whether such communication is to be further forwarded.

185. In all cases of shipwreck or other marine disaster, occurring at or near a station, the observer in charge will forward the following information to this Office, by telegraph, as soon as it can be obtained from the crew of the life-saving station or other authority. This information is additional to that provided for in the preceding paragraph.

1. Name of vessel, hailing port, port to which bound, and nationality.
2. Rig and tonnage.
3. Name of captain and number of crew and persons on board.
4. Whether passenger or freight; cargo.
5. Place where vessel is ashore.
6. Wind, weather, and state of the sea.
7. Time of day and state of tide.
8. Time of launching boat, raft, or life-car.
9. Time of return from wreck.
10. Number of lives lost and saved, with names and residence.
11. What assistance, if any, is needed.

186. In case assistance is not required the fact should be stated in a telegram. In making the report care should be taken not to confound rumors with facts. The observers should report what they know of their own knowledge and what they may obtain from reliable sources.

187. A wreck knapsack containing the articles mentioned in the following list, will be kept packed at each sea-coast station, and the articles will never be used except in case of wreck.

WRECK KNAPSACK.

One (1) box-sounder.
Fifty (50) Telegraph Forms, 201.
Fifty (50) Telegraph Forms, 202.
One (1) package telegraph paper.
One (1) quire letter paper.
Four (4) lead pencils.
One (1) pair climbers.
One (1) pair cutting plyers.
Fifty (50) feet line wire, No. 9.
Fifty (50) feet insulated wire.
One (1) three-cornered file.
One (1) hatchet.
One (1) pound candles.
Four (4) insulators and brackets.
One (1) dozen spikes.
One (1) hand vice for splicing.
One (1) vice strapped for pulling up slack.
One (1) candle-stick.

188. Whenever a wreck of special importance, or one involving great risk of life or property is reported on the repair section of any station on the sea-coast line, the observer in charge will, after having fully notified this Office, and having alarmed the life-saving station, if any in his vicinity, order the assistant to take telescope and strap, signal-kit, canteen and knapsack (or necessary telegraph instruments and implements if the knapsack has not been furnished), and proceed to a point near the scene of the wreck, cut the wire, open a telegraph way-station, and at once report his arrival to this Office, giving all information in his power.

The assistant will remain on duty at the wreck station until recalled by orders from this Office, and will transmit all telegrams to and from the wreck.

The observer will be left in charge of the regular station and will forward a report of the wreck to this Office, giving time the wreck occurred and time the report of the disaster was received at the station.

Should the scene of the wreck be so far from the station as to render transportation for signal equipments necessary, the observer will hire the necessary transportation at the lowest possible rate.

The time received or sent will be carefully noted on all messages, and both time received and sent will be noted on messages relayed at any office.

189. Messages referring to wrecks will take precedence over all messages excepting Cautionary Signals, and operators at other stations will always give way to this Office or wreck station. Messages giving notification of wreck to this Office, or immediate danger to life will be the only exception to this rule, and these messages will take precedence of Cautionary Signals.

Vessel reports from Cape Henry, Breakwater, and Sandy Hook will take precedence over all messages except wreck messages, life danger messages, and Cautionary Signal messages.

If the line is telegraphing, the notification "Wreck message," "Life danger message," or "Vessel report," which will be sent immediately

after breaking, will be sufficient notice for all other operators to give way.

190. The report of a wreck telegraphed to this Office, will, as it passes the different stations (though the transmission to this Office is not to be delayed for this purpose), be given in copy to superintendents of Life-Saving Service, life-saving stations, commanding naval, revenue marine, and military officers, presidents of seamen's humane societies, chief officers of wrecking companies or steamers, or any from whom immediate aid can go; but for this purpose copies must be taken and sent out by messengers, or assistants, or hired messengers.

191. The lines cannot be thrown open to unauthorized reports or statements of wrecks, &c., for publication. All communications made public from the offices of the Signal Service have the color of official authority and must be officially authenticated.

192. Copies of reports, communications, &c., provided by these Instructions will therefore be sent under envelope to the authorities or persons named, and will not be bulletined except by direction from this Office.

193. The first duty of the observer or person in charge of any station, is to remain at his key until he is sure the message announcing danger or wreck has passed out of charge of his station, and an answer, if one is likely to come from this Office, or any other authority, has been received.

194. During the time of a wreck the telegraph instruments must be most carefully watched, and every care taken to see that there is no bad working or delay.

195. As soon as possible after the wreck, the observer will forward a full account, in writing, of the disaster, accompanying the report by copies of all messages sent and received.

196. A small "A" tent with camp stool or chair and camp-table will be kept at each station and will be sent to the wreck station (if they are needed) with as little delay as practicable. The opening of a wreck station, which may do infinite good by one or two messages only, will not be delayed to await these articles.

197. In carrying out these instructions, observers must act promptly, and intelligently, and forward the information item by item, as received, instead of waiting until all is collected.

198. In cases of need, the observer will promptly communicate information along the coast to other life saving stations, light-houses, and places from which aid may be given.

199. Each observer must have a thorough knowledge of the General Service and International Signal Codes, and the manner of using them for actual work, and to have sufficient knowledge of telegraphy to send and receive at a rate of speed not less than fifteen words per minute.

200. In using the flags of the International Code, *for practice*, the six foot flag of the General Service Code will be displayed at the top of *every* hoist, as a distinguishing signal, and to prevent misunderstanding on the part of vessels within sight.

201. "Attention" signals or "calls" from any passing vessel will be promptly acknowledged by the observer, and all proper inquiries answered. A report of all such calls, inquiries, and answers will be made to this Office.

202. In cases of vessels appearing at any Coast Signal station, connected with this Office by the Signal Service telegraph lines, and signaling for the "Indications," or questioning with regard to the danger in pursuing any certain course as to any port, or as to the character of the weather to be expected on any portion of the coasts of the United

States, the observer in charge of station will, in answer, give as full information as the "Indications" telegraphed from this Office afford. Should any doubt arise of the proper answer to be made, he will telegraph at once to this Office giving in full the message received, and will signal the vessel, "Message has been forwarded to the Chief Signal Officer; answer expected immediately."

TELEPHONE SECTIONS.

203. Telephone stations on the sea-coast lines will be known as Signal Service Telephone Stations, and will be distinguished by sections, and by numbers in sections: thus, No. 1, 2, or 3, &c., Telephone Section A, B, C, &c.

204. The senior sergeant on duty on the section, or other enlisted man of the Signal Corps, designated by this Office, will have immediate charge of the section under the supervision of this Office, and all matters relating to its management, maintenance, and connections will be under his supervision. He will test the telephone line each morning, immediately after sending to this Office his 7 a. m. meteorological report, calling the stations in succession, and report result of test to this Office without delay. In case the line is down or in trouble so that he cannot raise or satisfactorily communicate with any station, the repair-man at the Signal Service station nearest the fault will be at once ordered out to find and remove the trouble. The telephone line will also be tested at 2 p. m., and the result of the test telegraphed to this Office.

205. The observer in charge of the section will inspect it at least once in three months, and he will be held strictly responsible that the section is maintained in good working condition. He will carefully instruct the captains of the life-saving crews, and one selected man from each crew, in the working of the telephone and the manner of making ordinary repairs.

206. All messages transmitted over the wires of the Signal Service are subject to the supervision of the Chief Signal Officer.

207. The sergeant in charge of a telephone section will be held responsible that no improper or doubtful message is transmitted over the wires without the express sanction of the Chief Signal Officer. Questionable messages will be forwarded to the Chief Signal Officer, without delay, for his action. The signal station rules upon this subject will be closely observed.

208. Whenever a wreck is discovered near any of the stations on the section, the fact will be reported at once, by telephone, to the observer in charge of section, who will cause the nearest life-saving station to be at once notified. In case communication with the observer in charge is prevented or cannot be immediately had, notice of wreck will be telephoned to the nearest Signal Service station and the observer in charge of that station will take the necessary action.

209. The assistant at the signal station nearest the wreck will proceed to the scene of wreck, as is provided in existing orders. When there is a life-saving station near the scene of wreck, the assistant may open the wreck station in such station keeper's house and send messages by telephone. The wreck knapsack will always be carried by assistants when on wreck duty.

210. The repair-men in making repair trips will carefully examine the telephone wire and instruments and see that proper care is taken of the instruments and line material at the life-saving stations, and will promptly report any neglect to the enlisted men in charge of the stations at

which they are serving, by whom the report will be forwarded, through the observer in charge of the section, to this Office.

211. Whenever messages are received at any station on the sea-coast telegraph line for transmission to any point on the telephone section, they will be telegraphed to the Signal Service station nearest that life-saving station, and from thence will be forwarded to the life-saving station addressed by telephone.

212. The legend "Signal Service U. S. Army," will be stamped or printed on all call-bells and telephones hereafter used in the Signal Service.

213. In seasons when the life-saving stations are occupied it is expected that at all hours for testing telephones at Signal Service stations (unless in case of some disaster), at least one man will be on duty at each life-saving station to make the proper answers, etc., in order that it may be known every telephone station is in working order.

PROPERTY.

214. Blank forms, entitled "Report of Signal Service Property," Form 26 A, will be furnished each observer for making out a quarterly report of the property at his station, which report will be rendered at the expiration of the quarters ending, respectively, March 31, June 30, September 30, and December 31, of each year. This report will be filled out in the following manner:

All property received from this Office, and purchased at the station by proper authority from the Office, will be taken up on report as received during the respective months for which invoices are sent; and the aggregate of property received during the quarter (together with that on hand to be accounted for from last report) brought down in the line opposite the word "Total."

215. Bills for all properly authorized improvements, repairs, or necessary work at the various stations of observation *must* be forwarded so as to reach this Office as near the first day of the month succeeding that in which the work has been done as may be practicable.

In the transmission of bills to this Office for payment, or the return of receipted vouchers here, they must invariably be accompanied by a letter of transmittal, enumerating the inclosures thereto.

216. Bills forwarded in the name of the sergeant, or other person in charge of a station, for cash paid, must be accompanied in all instances by memorandum bill receipted, made out in the handwriting of the party to whom the money may have been paid, in support of same. Bills of this nature without such receipt will not be considered.

217. It is required that bills for rent of office, gas consumed, &c., be rendered monthly, and in every case the observer is directed to procure such bills and forward them promptly on or before the expiration of each month.

Bills must be rendered, in every instance, at the time prescribed, and when it is not possible to procure the bills from creditors, the sergeant or assistant in charge will make up a memorandum-bill himself, and forward it to this Office at the time designated, with explanation as to why so rendered.

218. In making applications for authority to renovate office-rooms, painting, papering, or repairs of any nature, estimates will, whenever practicable, be obtained from two or more responsible parties of the cost of the same, and forwarded with such application.

219. Whenever an article of office furniture, fuel, or supplies of any

description whatever, is purchased by an observer, under authority from this Office, it will be entered on a copy of Form 24 A, as "received by purchase," with the name of the party furnishing it, properly dated and signed, and accompanied by the memorandum-bill of the same, will be forwarded to this Office, by mail, *on the day* on which the purchase was made.

220. All vouchers must contain the autograph signature of the party or firm in whose name they are made, and must in no instance be signed by a clerk or others for them, except where necessity occasions the signing of a voucher by an attorney or agent, in which case that agent's power of attorney must accompany the voucher so signed.

221. When an observer is relieved from the charge of a station, he will turn over, on proper invoices, to his successor, all property and stores for which he is officially responsible, and will take duplicate receipts therefor, one copy of which he will retain, and forward the other to this Office with a final report, on the regular form, of the property for which he was accountable at the date of his relief, made out in precisely the same manner as the regular quarterly report.

One copy of the invoice of property so transferred will also be forwarded to this Office by the observer taking charge.

222. When public property is receipted for by an observer, he must make a careful examination of it, and forward a written report of such examination to this Office. In case of damage to property or stores, excepting the ordinary wear and tear, the invoices, receipts, and final reports must state the condition of each article.

223. Sergeants or other enlisted men of the Signal Corps receipting for Government property, at a signal-station or elsewhere, will be held personally responsible for such property; and, to guard against pecuniary loss, will assure themselves by personal inspection that every article of property receipted for is actually at the station, and in the condition specified in the receipt.

224. Authority must be obtained from this Office for making all repairs and purchases at stations, except those in which the emergency is too great to await authority, and those enumerated in paragraph 230 of these Instructions, and all applications for such authority must be made on the proper form furnished for this purpose, and must set forth the necessity for the expenditure, and state the estimated amount. In emergencies, observers must secure services and make purchases at the lowest rates possible.

When bills are forwarded for authorized expenditures or purchases, the letter transmitting them must refer, in all instances, to the authority upon which they were contracted, or such reference noted on the bill.

225. No public property will be used or labor employed by observers, for any purpose whatever, without special authority from this Office.

226. When any article of public property, not of an expendable nature for which an observer is responsible, becomes unfit for service, from any cause whatever, he will report the facts in the case to this Office and submit them for the action of the inspector first visiting the station, but will not drop such article from his returns until authorized from this Office to do so.

227. Observers will endeavor, by timely repairs, to keep all property for which they are responsible in serviceable condition.

228. If any article of public property should be lost or damaged through the neglect or fault of any observer or assistant, the money-value thereof will be stopped against his monthly pay.

229. A rigid economy must be practiced by all observers in the

expenses of their several stations, and all irregularities and extravagances will be promptly corrected by charging all excesses to the observers at fault.

230. The following articles and expenditures will be allowed at each station, and may be purchased at the prices named, by each observer, without other authority, when the station is first established:

One room, for the performance of his duties, will be rented by the month, at each station, but no more than \$18 per month will be paid therefor, without special authority from this Office; one desk, (price not to exceed \$20;) one table, with drawers, (stained pine, and not to exceed \$6;) one wash-stand, (at a price not exceeding \$2;) two to four chairs, (not to exceed \$2 each;) one stove, with pipe, (not to exceed \$25;) one coal-scuttle; one fire-shovel; one water-bucket; one cup or dipper; one tumbler; one basin; one large lamp; one oil-can; one dust-pan and brush; one broom; one common spittoon; one lantern. The above-named articles must be of a cheap, plain, and substantial kind. Memorandum-bills (unreceipted) for rent, labor, and purchases, will be sent to this Office, and will be settled at the earliest opportunity.

231. Upon the shipment, by express, of any article of property which may be ordered to be turned in to this Office, observers are directed to procure from the express agent at their stations receipts in duplicate for the package or box, and forward them to this Office, by mail, on the date of shipment. Articles so returned may be dropped from "Reports of Property" without awaiting authority, with a proper note as to their disposition.

232. Memorandum-bills for labor and for articles purchased must be sent in separately.

233. Applications for authority to purchase fuel must be made on the prescribed form with statement of amount and period for which required. The cost of same must be given, including the expense of labor of carrying to the observer's office together with the amount and cost of last preceding purchase.

234. The pay and allowances of sergeants and other enlisted men serving as assistant observers are obtained from three different sources, and will be drawn through the Property and Disbursing Officer of the Signal Service, U. S. A., at the end of each month, on the receipt at this Office of the following blanks, signed in duplicate:

5—PAY DEPARTMENT.

Number on pay-roll ———.

Received of ———, Paymaster, U. S. Army, this ——— day of ——— 188 —, ——— ¹⁰⁰ dollars, in full of my account, as appears from the pay-rolls for the month of ———, 188 —, by check No. ———, on Assistant Treasurer U. S., New York.

(Signed in duplicate.)

(Sign here.) ——— ———

2d. Form Y—SUBSISTENCE DEPARTMENT.

(FORM Y.)

THE UNITED STATES,

To John Thompson, Sergeant, Signal Corps, U. S. A., DR.

	Dollars.	Cents.
For commutation of rations, while on extra duty as ———, at ———, from ——— to ———, 188 —, inclusive, ——— days, at 75 cents per day		

I certify that the above account is correct and just; that the commutation was made by order of the Secretary of War, and was necessary for the public service, there being no opportunity for messing.

Received at _____, this _____ day of _____, 188____, from _____, C. S., United States Army, the sum of _____ dollars and _____ cents, in full of the above account.

(Signed in duplicate.)

JOHN THOMPSON,
Sergeant, Signal Corps, U. S. A.

3d. Signal Service Receipt-Roll.—QUARTERMASTER'S DEPARTMENT.

(Voucher to Abstract B.)

(Form No. 13.)

THE UNITED STATES,

To _____, DR.

_____ *Signal Corps, U. S. Army.*

On extra duty as _____, at _____

	Dollars.	Cents.
For extra duty pay from _____ to _____, 188____, inclusive, _____ days, at _____ per day		
For commutation of fuel from _____ to _____, 188____, at \$_____ per month		
For commutation of quarters from _____ to _____, 188____, at \$_____ per month		

I certify that the above amount is correct and just; that the services were rendered as stated; that they were necessary for the public service, and are borne on my roll of extra-duty men (Form 3) for the month of _____, 188____, and that no fuel and no quarters in kind have been furnished.

A. A. Q. M., Signal Service.

Received at Washington, D. C., _____ day of _____, 188____, of _____, quartermaster United States Army, the sum of _____ dollars and _____ cents, in full of the above account.

JOHN THOMPSON.

(Signed in duplicate.)

These vouchers will be signed by observers and their assistants, one set by each man, exactly as shown in the above illustrations.

235. *No part of the body or the receipt of either form will be filled up before transmission, and they must be forwarded to this Office at such time as will insure their receipt before the 20th of each month, otherwise no pay can be drawn on them until the end of the following month.*

236. *Enlisted men of the Signal Corps will not be allowed to sell or otherwise dispose of any of the above-mentioned accounts, (vouchers for pay and commutation,) nor will they be permitted to draw or give orders upon this Office, nor any of the officers connected therewith, without special authority.*

237. The following tables show the amount of monthly pay to be

received by enlisted men of the Signal Corps for the different years of service, and the sources from which it is received:

Estimate of monthly pay proper and clothing allowance.

FOR SERGEANTS.

Year of enlistment.	Pay proper.	Stoppages.	Amount paid.	Amount retained each month.		Total amount due each month.
		Retained pay and Soldier's Home.		Clothing allowances.	Retained pay.	
1	\$34 00	\$0 12	\$33 88	\$5 11	-----	\$38 99
2	34 00	13	33 87	3 45	-----	37 32
3	35 00	1 12	33 88	3 67	\$1 00	38 55
4	36 00	2 13	33 87	3 45	2 00	39 32
5	37 00	3 12	33 88	2 62	3 00	39 50

FOR CORPORALS.

1	\$20 00	\$0 12	\$19 88	\$5 05	-----	\$24 93
2	20 00	13	19 87	3 41	-----	23 28
3	21 00	1 12	19 88	3 63	\$1 00	24 51
4	22 00	2 13	19 87	3 41	2 60	25 28
5	23 00	3 12	19 88	2 59	3 00	25 47

FOR PRIVATES—FIRST CLASS.

1	\$17 00	\$0 12	\$16 88	\$4 90	-----	\$21 78
2	17 00	13	16 87	3 29	-----	20 16
3	18 00	1 12	16 88	3 52	\$1 00	21 40
4	19 00	2 13	16 87	3 29	2 00	22 16
5	20 00	3 12	16 88	2 51	3 00	22 39

FOR PRIVATES—SECOND CLASS.

1	\$13 00	\$0 12	\$12 88	\$4 80	-----	\$17 68
2	13 00	13	12 87	3 22	-----	16 09
3	14 00	1 12	12 88	3 48	\$1 00	17 36
4	15 00	2 13	12 87	3 22	2 00	18 09
5	16 00	3 12	12 88	2 46	3 00	18 34

The amount retained—\$1 each month from the pay of third year, \$2 from fourth year, and \$3 from fifth year—will not be paid until final discharge from the service, and will be forfeited unless the soldier shall have served faithfully to date of discharge.

The pay per month of a soldier re-enlisting after five years service, which must be done within 30 days, will be \$2 per month more than that of the fifth year of his former term, \$1 of which is retained until discharged from the service. He will also receive an increase of \$1 per month for each additional re-enlistment.

Clothing allowance per month.

Rank.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total for five years.
Sergeant.....	\$5 11	\$3 45	\$3 67	\$3 45	\$2 62	\$219 52
Corporal.....	5 05	3 41	3 63	3 41	2 59	217 10
Private, 1st class.....	4 90	3 29	3 52	3 29	2 51	210 16
Private, 2d class.....	4 80	3 22	3 48	3 22	2 46	206 24

But no clothing allowance will be paid the soldier except on "final statements." When clothing is drawn, if the allowance is exceeded it will be settled by the soldier on the 30th June and 31st December of each year.

Monthly estimate of quartermaster allowances and commutation of rations.

MONTHLY ESTIMATE OF QUARTERMASTER ALLOWANCES.					MONTHLY ESTIMATE OF COMMUTATION OF RATIONS.		
No. of days in the month.	Fuel - rate per month.	Quarters—rate.	Extra pay—rates.	Total.	No. of days in the month.	Rate per day.	Total.
28	\$8 00	\$10 00	\$9 80	\$27 80	28	\$0 75	\$21 00
30	8 00	10 00	10 50	28 50	30	75	22 50
31	8 00	10 00	10 85	28 85	31	75	23 25

Extra-duty pay is allowed enlisted men only in special cases.

Estimate of monthly pay of sergeants, corporals, and privates.

SERGEANTS.

FIRST YEAR.					FOURTH YEAR.				
No. of days in the month.	Pay proper.	Quartermaster's Department, pay.	Commissary pay.	Amount of pay received monthly.	No. of days in the month.	Pay proper.	Quartermaster's Department, pay.	Commissary pay.	Amount of pay received monthly.
28	\$34 00	\$18 00	\$21 00	\$73 00	28	\$36 00	\$18 00	\$21 00	\$75 00
30	34 00	18 00	22 50	74 50	30	36 00	18 00	22 50	76 50
31	34 00	18 00	23 25	75 25	31	36 00	18 00	23 25	77 25
SECOND YEAR.					FIFTH YEAR.				
28	\$34 00	\$18 00	\$21 00	\$73 00	28	\$37 00	\$18 00	\$21 00	\$76 00
30	34 00	18 00	22 50	74 50	30	37 00	18 00	22 50	77 50
31	34 00	18 00	23 25	75 25	31	37 00	18 00	23 25	78 25
THIRD YEAR.									
28	\$35 00	\$18 00	\$21 00	\$74 00					
30	35 00	18 00	22 50	75 50					
31	35 00	18 00	23 25	76 25					

Sergeants in charge of display sections, and those mustered under authority from the Secretary of War receive, in addition to the above rates, 35 cents per day.

Estimate of monthly pay, &c.—Continued.

CORPORALS.

FIRST YEAR.					FOURTH YEAR.				
No. of days in the month.	Pay proper.	Quartermaster's Department, pay.	Commissary pay.	Amount of pay received monthly.	No. of days in the month.	Pay proper.	Quartermaster's Department, pay.	Commissary pay.	Amount of pay received monthly.
28	\$20 00	\$18 00	\$21 00	\$59 00	28	\$22 00	\$18 00	\$21 00	\$61 00
30	20 00	18 00	22 50	60 50	30	22 00	18 00	22 50	62 50
31	20 00	18 00	23 25	61 25	31	22 00	18 00	23 25	63 25
SECOND YEAR.					FIFTH YEAR.				
28	\$20 00	\$18 00	\$21 00	\$59 00	28	\$23 00	\$18 00	\$21 00	\$62 00
30	20 00	18 00	22 50	60 50	30	23 00	18 00	22 50	63 50
31	20 00	18 00	23 25	61 25	31	23 00	18 00	23 25	64 25
THIRD YEAR.									
28	\$21 00	\$18 00	\$21 00	\$60 00					
30	21 00	18 00	22 50	61 50					
31	21 00	18 00	23 25	62 25					

Corporals and privates in charge of a station receive, in addition to above rates, 35 cents per day. All stations in the Military Division of the Pacific receive special rates for fuel, which are determined monthly; quarters, \$20.

PRIVATES—FIRST CLASS.

FIRST YEAR.					FOURTH YEAR.				
No. of days in the month.	Pay proper.	Quartermaster's Department, pay.	Commissary pay.	Amount of pay received monthly.	No. of days in the month.	Pay proper.	Quartermaster's Department, pay.	Commissary pay.	Amount of pay received monthly.
28	\$17 00	\$18 00	\$21 00	\$56 00	28	\$19 00	\$18 00	\$21 00	\$58 00
30	17 00	18 00	22 50	57 50	30	19 00	18 00	22 50	59 50
31	17 00	18 00	23 25	58 25	31	19 00	18 00	23 25	60 25
SECOND YEAR.					FIFTH YEAR.				
28	\$17 00	\$18 00	\$21 00	\$56 00	28	\$20 00	\$18 00	\$21 00	\$59 00
30	17 00	18 00	22 50	57 50	30	20 00	18 00	22 50	60 50
31	17 00	18 00	23 25	58 25	31	20 00	18 00	23 25	61 25
THIRD YEAR.									
28	\$18 00	\$18 00	\$21 00	\$57 00					
30	18 00	18 00	22 50	58 50					
31	18 00	18 00	23 25	59 25					

Estimate of monthly pay, &c.—Continued.

PRIVATES—SECOND CLASS.

FIRST YEAR.					FOURTH YEAR.				
28	\$13 00	\$18 00	\$21 00	\$52 00	28	\$15 00	\$18 00	\$21 00	\$54 00
30	13 00	18 00	22 50	53 50	30	15 00	18 00	22 50	55 50
31	13 00	18 00	23 25	54 25	31	15 00	18 00	23 25	56 25

SECOND YEAR.					FIFTH YEAR.				
28	\$13 00	\$18 00	\$21 00	\$52 00	28	\$16 00	\$18 00	\$21 00	\$55 00
30	13 00	18 00	22 50	53 50	30	16 00	18 00	22 50	56 50
31	13 00	18 00	23 25	54 25	31	16 00	18 00	23 25	57 25

THIRD YEAR.				
28	\$14 00	\$18 00	\$21 00	\$53 00
30	14 00	18 00	22 50	54 50
31	14 00	18 00	23 25	55 25

A deduction from the foregoing estimates of 12½ cents per month is made for the Soldiers' Home.

In the third year one dollar per month is *retained*, in the fourth year two dollars per month, and in the fifth year three dollars per month, which is paid at the expiration of term of service, provided the enlisted man has served faithfully until discharge.

In addition to the above rates of pay, enlisted men will receive the usual allowance for first, second, third, and fourth re-enlistments.

238. For purposes of administration and supply, the enlisted men of the Signal Corps, U. S. A., will be divided equally into a battalion of four companies.

The commanding officer at Fort Myer, Va., will be, *ex-officio*, the battalion commander, and will assign a commissioned officer to the command of each company.

The post quartermaster at Fort Myer is designated the battalion quartermaster.

239. All the enlisted men of the Corps, except those at Fort Myer, Va., will be mustered, for pay, monthly.

240. All requisitions for clothing and equipments will, from the date of the receipt of this order, be sent to the battalion quartermaster on Form No. 49. To save expense, these requisitions will be sent in semi-annually in time to reach Fort Myer before the 15th day of March and the 15th day of September of each year, so that the articles may be shipped with the regular supplies to stations. Requisitions at other times must be accompanied by explanations of necessity to justify the irregularity.

241. All accounts of the enlisted men of the Signal Corps will be kept under the direction of the commanding officer at Fort Myer, to whom they will be transferred at once by the Acting Signal Officer in charge at this office.

242. All Discharges, Final Statements, and other papers relating to soldiers' accounts, except enlistments and the warrants of non-commissioned officers, will, in future, be prepared at Fort Myer.

243. Whenever application for discharge is made upon grounds of physical disability, the forms prescribed by General Regulations, 1863, will be used, so far as they are practicable. Men on station will have

the Surgeon's Certificates filled up by an Army Surgeon, if they are near one, or by a doctor of good standing. The certificates of service, &c., will be signed by the commanding officer at Fort Myer. Blanks can be procured (in duplicate) from the nearest military post on application, which, in such cases may be made direct. Great care will be taken that the Surgeon's Certificate shall give the degree of disability.

FORM NO. 49, REQUISITION FOR CLOTHING.

(To be made semi-annually.)

For _____

At _____

Articles: _____

_____,
Signal Corps, U. S. A.

Date: _____

(Notice to Commanding Officer of Battalion.)

OFFICE POST QUARTERMASTER,
FORT MYER, VA.

Issued this _____ day of _____
to _____

No.	Articles.	Cost.	
		DOLLS.	CTS.
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Please charge same and notify me.

Post Quartermaster.

*(Notification to Post Quartermaster.)*HEADQUARTERS POST FORT MYER, VA.,
_____, 188____Charges against _____ Signal Corps,
U. S. A., on account of Clothing, &c., issued _____,
188 , per memorandum, charged on rolls.
_____,
_____,*Commanding Post.*

244. Whenever any new instrument, sent to replace a broken or unserviceable one, is received in good condition, the unserviceable one will be returned to this Office, unless special instructions are given to retain it, or it can be repaired at the station.

245. All instruments or public property, of any character whatever, returned to this Office by sergeants or other enlisted men of the Signal Corps, must have a tag or slip of paper securely attached thereto, indicating the station whence it comes, marked "Returned from _____, under instructions from O. C. S. O."

246. Timely requisition will be made for books of record, stationery, forms, &c., to insure their receipt before the supply on hand is exhausted.

247. Requisitions for forms and stationery will be made semi-annually by mail, and will embrace all the different varieties required for use at stations.

These estimates must be made out carefully, and embrace all forms and articles of stationery, &c., required for six months' supply, making ample allowance for such increase of work as seems probable from past experience.

Requisitions must not be made at irregular times, except in cases of absolute necessity, and must in all cases be on the regular printed form, or in writing.

248. The postage on all official matter transmitted through the mails must be prepaid by postage-stamps, which will be furnished on requisition. A monthly return of stamps received and expended will be made on the regular blanks, and forwarded to this Office. These returns must be made promptly at the expiration of each month, showing how many of each denomination of stamps are on hand at the closing of the last mail of the month. A memorandum book furnished for this purpose will be kept, in which will be noted each package or letter mailed, stamped with the official stamp, entering therein the address and the number and denomination of stamps used on each and every piece of official mail-matter transmitted; these data will be kept up to enable the observers to make reports to this Office as to the exact disposition of stamps, which report is liable to be called for at any moment. In making a final report of postage-stamps, &c., the same rules will be observed as apply to transfer of property.

249. The following notice will be kept posted in some prominent place in each office:

NOTICE.

Enlisted men of the Signal Corps will not be permitted to draw or give orders upon this Office, or any of the officers connected therewith, without special authority.

STATION SUPPLIES.

REPORTING STATIONS.

250. The following-named articles are required for the complete outfit of stations making full telegraphic reports:

I. INSTRUMENTS, &C.

- | | |
|----------------------------------|--|
| 2 Anemometers. | 2 Maximum thermometers. |
| 1 Anemoscope, small. | 2 Minimum do. |
| 2 Barometers (mercurial). | 1 Large wind-vane. |
| 1 Barometer, aneroid, compared. | 1 Self-register for anemometer. |
| 2 Wet-bulb thermometers. | 2 Measuring sticks. |
| 1 Rain-gauge. | 1 Compass. |
| 1 Tool-box (complete). | 1 Greaser for instruments. |
| 1 Pair eye-glasses. | 1 Dark lantern. |
| 2 Hygrometer brushes. | 1 Pair shears. |
| 1 Regulator clock. | 1 Calendar. |
| 1 Bottle clock-oil. | 1 Tin thermometer tester. |
| 6 Hygrometer wicks. | 5 Pounds of mercury. |
| 1 Telescopic rod for anemometer. | 3 Cells Eagle battery. |
| 1 Battery brush. | 15 Pounds sulphate of copper. |
| 2 Water thermometers and 1 case. | Supply of wire for anemometer connections. |
| 50 feet cord for do. | |
| 2 Exposed thermometers. | |

II. FURNITURE, &C.

- | | |
|-----------------------|---------------------------|
| 1 Desk. | 4 Chairs. |
| 1 Washstand. | 1 Coal-scuttle. |
| 1 Stove. | 1 Water-bucket. |
| 1 Fire-shovel. | 1 Tumbler. |
| 1 Cup or dipper. | 1 Lamp. |
| 1 Basin. | 1 Dust pan and brush. |
| 1 Oil-can. | 1 Feather-duster. |
| 1 Broom. | 1 Water-cooler. |
| 1 Spittoon. | 1 Basket for waste paper. |
| 1 Office-case. | 1 Hatchet. |
| 1 Office-sign. | 1 Monthly Mean frame. |
| 2 Map-frames. | 2 Bulletin boards. |
| 1 Scrubbing-brush. | 1 Foot mat. |
| 1 Table with drawers. | Window curtains. |

III. BOOKS, FORMS, AND STATIONERY.

- | | |
|------------------------------------|---|
| 1 Bible. | 1 Set, Annual Reports of Chief Signal Officer. |
| 1 Dictionary. | 1 Circular on Practical use of Met. Reports and Weather-maps. |
| 1 Pope's Telegraphy. | 1 Instructions to Observers. |
| 1 Guyot's Meteorology Tables. | 1 Smithsonian Directions for Met. Obs. |
| 1 Buchan's Handy-book. | 1 Set, Daily Bulletin (Synopses, &c.), bound. |
| 1 Loomis' Treatise on Meteorology. | |
| 1 Myer's Manual of Signals. | |
| 1 Piddington's Horn-book. | |
| 1 Manual of Military Telegraphy. | |

1 Large Weather-map.	6 Months' supply of Form 107.
1 Daily Journal.	6 Months' supply of Form 203.
1 Record of postage-stamps.	50 Forms 24 A.
1 Record of Bulletins.	*6 Months' supply of Form 109 B.
1 Record of Letters Received.	30 Forms 113 A.
1 Record of Letters Sent.	60 Forms 133.
1 Expense Book.	50 Forms 201.
1 Cipher Hand-book.	30 Forms 304.
1 Monthly River Record.	10 Forms 115.
1 Monthly Meteorological Report (Form 113 A).	10 Forms 117.
6 Original Records of Observa- tions.	4 Forms 132 A & B.
6 Months' supply of O. B. Envel- opes.	6 Months' supply of Form 211.
3 Sheets blotting paper.	8 Property Reports.
10 Quires legal cap.	6 Months' supply of Pay vouch- ers.
1 Ivory paper-folder.	6 Months' supply of carbon paper.
1 Box pencil leads.	50 Small envelopes.
1 Penrack.	1 Quire envelope paper.
2 Rubber erasers.	10 Quires letter paper.
1 Sponge cup.	6 Lead pencils.
1 Stick sealing-wax.	6 Penholders.
1 Inkstand.	72 Pens (assorted).
1 Quart black ink.	1 Ruler.
2 Styli.	1 Piece of sponge.
2 Sheet-iron or tin tablet for mani- fold bulletins.	2 Spools of red tape.
1 Set springs for large weather map.	2 Bottles of red ink.
1 Set arrows and discs combined for large Weather-map.	1 Ruling-pen.
1 Bottle mucilage.	1 Shipman's file for Form 107.
1 Eraser.	50 Acknowledgments of Circulars.
6 Months' supply of Form No. 111, Bulletin.	4 Blank Estimates.
6 Months' supply of Form 204.	30 Stamp Returns.
	200 Record sheets for Anemometer.
	500 Barometer tags.
	1 Set Cipher cards.
	12 Forms Purchase or expendi- ture.

IV. CAUTIONARY SIGNALS.

251. At stations displaying Cautionary Signals, the following-named additional articles are necessary :

60 Forms 112.	2 8-foot white Cautionary Off-shore flags, Coast.
1 Record of Signals.	2 8-foot white Northwest Signal flags, Lakes.
2 6-foot red Cautionary Signal flags.	2 Sets small Signal Staves.
2 8-foot red Cautionary Signal flags.	1 Bed Lounge.
2 Cautionary Signal lanterns, red.	1 Cautionary Signal Indicator.
2 Off-shore or Northwest signals, white.	3 Months' supply of oil for Signal Lanterns.
2 6-foot white Cautionary Off-shore flags.	2 Sets halliards.

* Only to stations required to post with Bulletins.

V. SEA-COAST STATIONS.

252. In addition to the supplies noted in paragraphs I, II, and III, the following-named signal and telegraphic equipments are required at sea-coast stations:

Signal Equipments.—Kit Case.

- | | |
|-------------------------------|--|
| 2 Flags, { 4 feet, white. | 2 Flying extinguishers. |
| { 4 feet, red. | 1 Set of International Signal flags. |
| 3 Joints of staff. | 1 Book of National flags. |
| 2 Foot torches. | 1 International Code. |
| 2 Foot extinguishers. | 1 Lloyd's Marine Register. |
| 1 Wormer. | 1 Record of American and Foreign Shipping. |
| 2 Flying torches. | |

Haversack.

- | | |
|------------------------|-----------------------------|
| 10 Balls wicking. | 1 Pair of pliers. |
| 1 Flying flame shade. | 10 Gallons turpentine. |
| 1 Pair of scissors. | 1 Telescope. |
| 1 Canteen. | 1 Dozen boxes wind matches. |
| 1 5-gallon copper can. | 1 Telescope holder. |
| 1 Funnel. | 1 Binocular glass. |
| 1 Foot flame shade. | |

Telegraph Equipments.—Instruments.

- | | |
|----------------|-----------------|
| 2 Box sounders | 1 Pocket relay. |
|----------------|-----------------|

Repair Tools.

- | | |
|---|---|
| 1 Axe. | 1 Soldering pot with pan on top for dipping splice. |
| 1 Hatchet. | 2 Bars solder. |
| 1 Vise, strapped. | $\frac{1}{2}$ lb. soldering fluid. |
| 1 Vise, hand. | 50 Screw glass insulators and brackets. |
| 1 Pair climbers. | 1 Coil No. 9 wire. |
| 2 Pair pliers, cutting. | 1 Block and fall. |
| 1 Saddle mule, and one boat when necessary. | 1 Battery box. |
| 1 Long-handled shovel. | |

Forms.

- | | |
|--------------------------------|---|
| 200 No. 201, Message Sent. | 30 No. 213, Repairman's Weekly Trip Report. |
| 200 No. 202, Message Received. | |

VI. TELEGRAPH STATIONS.—(*Interior Lines.*)

253. The following-named articles are required at interior telegraph stations in addition to the standard meteorological supplies:

Instruments, &c.

- | | |
|---|--|
| 2 Relay magnets, } Signal Service | 2 Extra zincs for battery. |
| 2 Sounders, } standard. | 2 lbs. No. 14 office wire. |
| 1 Key, | 100 lbs. sulphate of copper. |
| 1 Plug switch cut-out, with lighting arrester and ground. | 1 Repair outfit as for sea-coast stations. |
| 2 Cells local battery (Eagles). | |

Terminal offices require main line battery and ground plate, and repeating offices one Signal Service standard repeater in addition.

Books and Forms.—One Year's Supply.

1 Check ledger.	5 Forms 25 C, Quarterly Requisition.
2 Record books.	300 Forms 214, Repairman's Trip Report (U. S. Tel.).
8 Messenger receipt books.	16 Forms 218, Monthly Labor and Material Report (U. S. Tel.).
200 Forms 201, Telegrams Sent.	100 Forms 36, Check Error Sheets.
200 Forms 202, Telegrams Received.	100 Forms 43, Statement Uncollected Messages.
16 Forms 35, Monthly Check Reports.	100 Forms 44, Statement Guaranteed Messages.
75 Forms 30, Weekly Acc't Current.	16 Forms 39, Statement War Department Messages.
300 Forms 34, Monthly Error Sheets (for headquarters station only).	
16 Forms 29, Monthly Acc't Current.	

VII. RIVER STATIONS.—(*Regular.*)

254. The following-named articles are required at river stations, in addition to the standard supplies enumerated in preceding paragraphs:

1 Standard River Gauge, Signal Service model.	6 Months' supply of Form 114.
6 Months' supply of Form 108.	Monthly River Record.

VIII. RIVER STATIONS.—(*Special.*)

1 Standard River Gauge.	} Signal Service model.	6 Months' supply of letter paper.
1 Standard Rain Gauge.		1 Tin tablet for manifold writing.
2 Books, Form 203.		10 Sheets carbon paper.
60 Forms 114.		1 Stylus.
6 Mos. supply of stamped envelopes.		1 Bottle black ink.
		3 Lead pencils.

IX. SUNSET STATIONS.

255. The following articles are required at sunset stations:

1 Thermometer.	1 Cipher book.
1 Wind-vane.	1 Set cipher cards.
1 Rain-gauge.	1 Stylus.
1 Measuring stick for rain-gauge.	12 Forms 121.
2 Books Form 203.	30 O. B. envelopes (stamped).
10 Sheets carbon paper for same.	1 Quire letter paper.
1 Tin plate for manifold writing.	1 Bottle black ink.
1 Compass.	3 Lead pencils.
1 Wrench.	2 Pen holders.
16 Screws.	24 Pens.

X. PRINTING STATIONS.

256. At stations issuing Farmers' Bulletins, the following-named additional articles are required :

Half gallon benzine.	1 Type-stand.
1 Blanket for press.	1 Autograph, electrotype.
1 ² Bodkin.	1 Farmers' Bulletin, electrotype.
1 ¹ Mitre-box.	1 Letter head, electrotype.
1 Lye-brush.	1 Indications, electrotype.
2 Job cases.	1 Pub. by co-operation, electro- type.
2 Type cases, single.	1 Synopsis, electrotype.
1 Pair type cases.	15 Feet of furniture.
1 ⁴ Pound cotton waste.	1 Composing-stick.
1 Galley.	1 Shooting-stick.
1 ¹ Pound black ink.	1 Imposing-stone.
10 Pounds leads.	50 Pounds type.
1 Box of lye.	1 Wrench.
1 Mallet.	1 Lye-pot.
1 Oiling can.	1 Chase.
1 Planer.	1 Benzine-can.
1 Printing press.	3 Feet of brass rule.
50 Quoins.	40 Reams paper, flat letter.
2 Ink-rollers.	1 Spatula.
1 Composing rule.	1 Pair tweezers.
1 Saw.	

XI. DISPLAY STATIONS.

257. The following articles are furnished display stations not taking meteorological observations:

2 8-foot Cautionary Off-shore or Northwest Signal flags.	500 Form 201, Telegraphic.
2 8-foot Cautionary Signal flags.	500 Form 202, Telegraphic.
2 Cautionary Off-shore or Northwest Signal lanterns, white.	2 Quires letter paper.
2 Cautionary Signal lanterns, red.	30 Stamped envelopes (official).
1 Book, Form 112.	36 Steel pens, assorted.
60 Form 112.	6 Lead pencils, Faber No. 2.
	2 Adhesive files.
	2 Sets halliards.

258. Observers in charge of stations, or their assistants, receiving instruments from postmasters or employes of the Post-Office Department, must thoroughly examine each instrument before receipting for it, and state distinctly on the receipt, over their own signature, whether it is received in good or in damaged condition, and, in case it is received in damaged condition, the nature of the damage.

GENERAL INSTRUCTIONS.

259. Each observer in charge of a station not supplied with an assistant from this Office will, as soon as practicable after arriving at his station, make arrangements with some competent person to perform his duties in case of sickness or disability. The person so selected must be carefully instructed in the use and care of the several instruments, in the manner of taking the observations, of making out and forwarding the weather-reports sent from the station, and the proper disposition of

those received from other stations. His name and regular post-office address will be reported to this Office as soon as the selection is made and also in the annual report. The employment of this assistant will be temporary only, and he will be paid at the end of each month in which the services were rendered, at the rate of compensation fixed by the Chief Signal Officer, on receipt of the proper vouchers at this Office, with a certificate from the observer stating the number of days employed and the dates thereof.

260. Whenever an office is moved from one part of a city, town, &c., to another part, or from one city, town, &c., to a neighboring one, in all cases where observations of the barometer are made, the extra barometer will be taken to the new office and simultaneous observations will be taken at hourly intervals from the station and extra barometers for at least two days before removing the station barometer. A copy of these readings will be forwarded to the Chief Signal Officer without delay.

To obtain the mean of the *actual barometer* for the month during which the office has been moved, reduce the readings taken before removal to what they would have been had they been taken at the height occupied by them after removal. To make this reduction, apply with its proper sign, the difference between the readings of the station and extra barometers, determined as above, to the readings taken before the change of *instruments*. On Forms 113 A draw a *heavy red line* to separate the observations taken before and after removal of barometers.

261. At all stations where there is an enlisted man on duty as an assistant, the observer in charge will give especial attention to his instruction in the theory as well as the practice of Meteorology, Signaling, and Telegraphy.

In order that this may be properly done the observer will require each assistant to make a weekly recitation from one of the following-named text-books, using them in the order given: Loomis' Treatise on Meteorology; Myer's Manual of Signals; Manual of Military Telegraphy and the Instructions to Observers. The assistants will be required to study thoroughly the first six chapters of Loomis, the Manual of Signals to page 96, and all of the other text-books named.

The ordinary station-work will be fully explained. Especial care will be taken in teaching the use of the several meteorological instruments and in the manner of making and correcting the regular observations. A monthly report of this instruction will be made to this Office on Form 304.

The inspectors of the Signal Service will, as a part of the inspection of a station, examine all enlisted men on duty in the above-named text-books and wand practice, and will report their proficiency to this Office.

Should the inspector report any man as incompetent in this examination it will be considered sufficient cause for discharge as unfit for the service.

262. The general orders and circulars issued from this Office must be carefully studied by all enlisted men on stations, and they will be regularly examined as to their knowledge of the same by the inspecting officer at each inspection of the station where they are serving.

263. Enlisted men serving as printers will be required to go through the same course of instruction as other assistants.

264. The duty of instruction must be carefully and faithfully performed, in order that worthy men may receive the promotion due them, and unworthy ones be disposed of.

265. No application from assistant observers for promotion will be favorably considered until the course of instruction has been completed in a satisfactory manner.

266. Appointment to the grade of sergeant will only be made from men who have successfully passed the school of instruction at Fort Myer, Va., and who have served for at least one year on station duties.

Observers in charge of stations will, in their annual reports, recommend their assistants who are eligible under the above rule and are deserving of promotion.

267. Inspecting officers will, in their inspection of stations, carefully examine as to the qualifications of assistants for promotion and will, at the termination of their trips, submit in writing to the Chief Signal Officer a list, giving their judgment as to the order of relative merit of the assistants who are eligible for promotion on the stations visited by them. Officers in charge of military telegraph lines will, after their inspection of lines, submit similar lists.

268. Appointment to the grade of corporal may be made of men not eligible for promotion as sergeant, for special meritorious services.

269. All applications by men on duty as assistants, for promotion, must be made in writing, and forwarded by the observer in charge of station, who will in all cases indorse thereon his report of the character, habits, and ability of the applicant. Privates in charge of stations may make their own applications.

270. The publication of the government weather reports by newspapers must be done without expense to the United States.

Observers will call the especial attention of the publishers of such papers as print the reports without the proper official heading, time and date, to the omission, and have it corrected when possible, as a matter of justice to this Office and to their readers.

271. Such places must be selected for posting the daily weather bulletins and maps as will insure their widest publicity at all hours of the day or night, and the names and locations of the places thus selected must be reported to this Office.

272. A large weather map will be hung up in the principal room of the board of trade or chamber of commerce, or both, and the state of the weather at the signal stations throughout the United States displayed upon it in the manner already described, as soon after the receipt of the morning report as practicable.

273. The telegraph must not be used by enlisted men of the Signal Service in communicating with this Office or with each other, except in cases of official importance. The cost of all telegrams considered unnecessary will be charged against the parties sending them.

274. Form 201 must always be used for telegraphic communications.

All official telegrams that are to be forwarded to this Office over commercial lines will be marked "paid."

275. Enlisted men on station duty must be especially neat and careful in their dress; and any negligence in this particular will be considered sufficient cause for the punishment of the offender.

276. All enlisted men of the Signal Corps on station duty will be inspected in uniform whenever the station at which they are serving is visited by an inspecting officer. Inspecting officers will, in their reports, make special mention of the uniform of each man inspected, and will make neglect of duty in connection with the uniform a subject of charges.

277. All rooms occupied as offices by the Signal Service at stations of observation must be kept scrupulously neat and clean.

The floors will be swept each morning, and, where not covered with

matting, will be thoroughly scrubbed on Saturday of each week, and this must be done without other expense to the United States than the cost of the necessary brushes, &c., except at stations not provided with one or more assistants, in which case this work will be done by the janitor.

The walls and furniture will be brushed daily, or oftener if necessary, and the practice of pasting or nailing unframed pictures, newspaper-slips, or other papers upon the wall will not be allowed.

Especial care will be taken at printing stations to avoid defacing or smearing the walls or other portions of the office with ink, and to prevent any accumulation of waste paper or litter of any description upon the floor.

The same care should be taken, as far as practicable, of the office rooms and furniture as each man on duty would take of his private rooms and property.

278. Observers will give close attention to the observation and record of all local premonitory signs of storms or changes of weather, and report them promptly to this Office. The following points should be particularly noted before, during, and after a storm or change of weather: Direction and force of the wind; kind, direction, motion and appearance of the clouds; action of the barometer and thermometer, and such other purely local causes as appear to influence the results.

279. The attention of observers in charge of stations is directed to the fact that they are required to make their reports absolutely correct, and that any shortcoming in this respect renders them liable to punishment. Aside from this, it should be constantly kept in mind that a single incorrect report may cause the loss of life and property to an unknown amount, and all reports must be made with this responsibility clearly in view. Whenever an observer is unable from any cause to get in his report, properly corrected, at the regular hours of report, he will *not* send the uncorrected portion. Observers will *never* send any report or part of report which they have reason to believe is incorrect, and will bear in mind that it is safer and more in accordance with instructions to omit a report than to make a false one.

280. *Official reports will not be forwarded to this Office until they have been carefully compared with the original records from which such reports are made.* Observers having assistants will have the latter read the original matter, and the observer will check and correct the copies to be forwarded to this Office, signing the reports only after he has thus assured himself of their *absolute correctness*. Assistants on station are not authorized to sign the name of the observer in charge to the official papers to be forwarded to this Office.

Observers without assistants will, if possible, procure some other person to assist in verifying their reports.

All errors that may be discovered at this Office upon examination of the reports will be checked against the respective observers, and noted as a part of their official record.

281. In preparing weekly or monthly meteorological forms for transmission to this Office, each column will be properly filled up with the data called for by the heading, and *if this cannot be done the omissions will be accounted for by an explanatory note on the form*, so that each form will be complete in itself.

282. Upon the receipt of an order, circular letter, or a circular at any station the observer in charge will carefully read it and forward to this Office a brief written synopsis of its provisions, as understood by him.

Whenever practicable, this synopsis will be written on the margin of

the printed form used to acknowledge the receipt of orders and circulars. The number and date of any order, circular, or circular letter affecting or changing any paragraph of these instructions will be entered in red ink in the margin opposite to the paragraph so affected or changed.

283. In the event of one or more instruments at a station becoming disabled and unfit for use, observers will fill up the space or spaces in the different forms intended for the readings of such instruments with the word "Blank," until they are repaired or replaced, and on each form or record-book in which such record is made, an explanatory note will be written setting forth the reason for the blank record. If the instruments cannot be properly and cheaply repaired at the station, they will be replaced by new ones, for which application must be promptly made.

284. On the first day of July (or within ten days thereafter), of each year, every observer in charge of a station will make out and forward to this Office a concise statement of the operation of his station for the preceding twelve months. This statement must show the changes, if any, that have been made in the location of the office or instruments, in the working force, and in the number of reports received during that period, with the authority for such changes. It will also show the amount of public interest taken in the service, and the classes of citizens deriving the greatest amount of benefit from the reports. If any marked advantages to commercial or other interests have been derived from the use of the reports or the display of cautionary signals, the facts in each instance will be briefly set forth.

285. Observers will make notes from time to time, during the year, so that this report can be forwarded immediately after the close of the period for which it is the record.

286. Observers in charge of stations will mail on Saturday of each week a copy of that day's issue (in case of weekly papers on the date of publication) of every newspaper published at their stations that contains the weather reports in any form, providing that such paper can be obtained without cost to the United States, and will also forward from time to time copies of such papers as may contain articles commenting upon the Signal Service, and will mark such articles in a conspicuous manner. They will also collect information bearing upon weather, cutting slips from newspapers not forwarded, supply date and time when omitted, and transmit all to this Office with the weekly forms.

287. All applications from enlisted men of the Signal Corps for furloughs or official privileges of any description must be made directly to this Office. Where the application is from an assistant on station duty, it must be forwarded by the observer in charge, who will note thereon his approval or disapproval of the same, and also state whether the station duties can be properly performed during the proposed absence without additional assistance.

288. Whenever an enlisted man returns to duty from a furlough or any other absence, he will immediately report to this Office the dates between which he was absent from station, and give authority by which he was absent. In case of sickness, he will also state the nature of the same.

289. The Secretary of War has power to grant discharges, which this Office is authorized to promise when applied for on proper grounds, and at times when no special injury to the service would result therefrom; but as a rule no application for discharge will be favorably entertained until after two years of faithful service, and not then, except as above specified.

In cases of urgent necessity, such application may be made by tele-

graph, but in all ordinary cases will be in writing, and forwarded by mail.

290. Whenever any enlisted man is relieved from duty in charge of a station he will, before leaving said station, inform his successor of the location of all map-frames, bulletin-boards and other government property for which he is responsible to this Office. He will also introduce him personally to the members of the meteorological committee, or committees of the chamber of commerce and board of trade, and give him such information in reference to the past record of the station and its local meteorological and other peculiarities as will enable the duties of the station to be intelligently discharged by such successor.

A written statement that the provisions of this paragraph have been complied with will be made to this Office by both observers.

291. Whenever, from any cause, an enlisted man or civilian in charge of a station is ordered to be relieved, and before obeying his orders, his successor must, immediately upon assuming charge, examine the station records, and, if they are not found complete to date, report the fact by telegraph to this Office and direct his predecessor to await further orders. Should the failure to keep the records up to date be due to willful neglect of duty, the person responsible will be brought to trial, or such other action taken as the interests of the service may require.

292. When an observer arrives at a station he will examine all letters and instructions on file, that he may become acquainted with the instructions which have been given to the station, and to familiarize himself with its workings.

293. All enlisted men of the Signal Corps will report in writing to this Office, immediately upon their arrival at a new station, the date at which they left the station from which relieved and the date of arrival at the station to which assigned. Assistants will forward this report through the observer in charge of the station at which they report.

294. In traveling from one station to another enlisted men must follow the route designated in the transportation order.

295. No excuse on the part of ANY enlisted man of the Signal Corps, for failure to perform any portion of his duty on account of sickness, will receive consideration at this Office unless such excuse is accompanied by a surgeon's certificate of disability, setting forth, in explicit terms, the nature of the sickness and the fact that the patient was incapacitated from performing duty, by reason of such sickness, during the time for which the excuse is offered.

296. Enlisted men or civilians in charge of stations on U. S. Military Telegraph Lines will not make or permit to be made at their stations experiments with telephones or other instruments without the express authority of the officer in charge of the division in which they are serving.

297. On the approach of the season during which navigation may be closed on the lakes, enlisted men in charge of "Lake stations" will confer with the meteorological committee, or in the absence of a meteorological committee, with those most interested in lake navigation at their stations, and report at once the date at which the display of cautionary signals should be discontinued on the lakes, and in the spring they will confer with the parties above named and report the date at which the display of cautionary signals should be resumed.

298. Whenever a message is received from this Office in regard to wrecks or storms, such message will be copied on Form 111, and one copy thereof posted in each bulletin-frame that is displayed in a public place at the station.

299. A copy of the "Register of the Officers and Vessels of the United

States Revenue Marine" is furnished to each sea-coast station for reference. On pages 20 to 23, inclusive, will be found the names of vessels, their stations, and the names of their commanding officers. This Register is furnished observers to enable them to give notice, by telegraph or messenger, of wrecks occurring at or near their stations, to the commanding officer of the nearest revenue marine vessel. Prompt notice will be sent in case of any dangerous wreck occurring at or near their stations.

300. Observers in charge of stations on or near the sea-coast will make special efforts to secure marine records from vessels entering their port and to this end must visit the captains in port and request observations from them.

Blanks must always be kept on hand for distribution and application promptly made to this Office for a supply when needed. The marine records obtained will be forwarded to this office, after a careful examination with a view to making them intelligible.

In furnishing the forms to captains of vessels, their nature and the proper manner of filling them up (as indicated by the ruled columns) will be thoroughly explained. The International Bulletin and the accompanying chart will be shown them and the value of the meteorological observations thus taken pointed out. They will also obtain permission to copy from logs of vessels data as to the weather experienced on voyages, from day to day, especial attention being given to positions of vessels, dates, kind of instruments used, &c.

301. Observers in charge of stations along the sea-coast will urge upon all Marine Observers the importance of keeping up their daily simultaneous meteorological observations, for a few days at least, while their vessels are in port, whether at home or abroad, the same as at sea. Said observations will enable this Office to check such records and approximately check other observations.

302. When the barometers of naval or merchant vessels are compared with the barometer at any station, a record of the comparative readings will be forwarded to this Office with a report in regard thereto.

303. Parties desiring to purchase maps or other Office publications will be required to forward the cost-price as given below.

Maps in one color, without reports or isobaric lines, 1½ cents each.

Maps on manifold paper, without reports or lines, in books of 100 each, \$2.75 per book.

Maps in one color, with current reports and isobars, 2 cents each.

Monthly Weather Review, 10 cents per copy.

Copies of bound volumes of the Daily Bulletins, with Synopses, Indications, and Facts, and Maps, \$2.25 each.

304. All communications in reference to the purchase of publications, whether containing money or not, must be forwarded to this Office for action, and payment must in all cases be made in advance, and the money, check, or money order sent direct to the Property and Disbursing Officer of the Signal Service, Washington, D. C.

One copy of this table of prices will be kept posted in the observer's office, for the information of the public.

305. On and after June 1, 1881, constant corrections will be furnished all stations by this Office for correcting barometric readings for elevation above sea level.

306. All changes in station or in the elevation of any instrument must be carefully noted in the Daily Journal, with date and amount of change, and also reported promptly to this Office.

SPECIAL INSTRUCTIONS.

307. In case of actual or anticipated neglect or refusal on the part of the employés of any telegraph company by which an observer is directed to transmit telegraphic communications, at the time and in the manner stated in the orders of the Chief Signal Officer to the observer in charge of a station, then in force he will proceed as follows:

(1.) He will prepare every telegraphic communication according to his instructions, and present each, at the time designated, at the proper office of the company for the reception of such communications. He will continue to present all reports, as to the regular tender of which the company has once been advised, until it has been notified by this Office that such tender will cease after a certain date, of which notice the observer will be informed.

(2.) He will, in advance of the presentation of all telegraphic communications, give specific notice to the company, during its usual hours of business, that an official communication of a certain-mentioned character, from the observer, addressed to a certain official person or persons (the address to be specified), will, at a certain subsequent hour (stating the hour), be presented at the office of the company for telegraphic transmission. This notice will provide for every regular report to be made during the ensuing twenty-four hours, and also will be given in advance of any special communication when practicable. Such notice will be in writing, addressed to the local manager of the company, and will be delivered, open, to the officer or employé of the company who may be in charge of the local office at the time of delivery. The written notice will be signed in duplicate by the observer, and one copy filed and retained by him. The following general form will be observed:

SIGNAL SERVICE, U. S. ARMY,
Observer's Office, _____, _____, 188 .

To _____,
Manager of the _____ Telegraph Company, at _____ :

SIR: As an agent of the War Department for the purpose of taking meteorological observations, in pursuance of the laws of the United States, and of preparing telegraphic communications relating thereto, and of presenting the same for transmission to telegraph companies, I have the honor to give notice hereby that, in accordance with orders received by me to that effect, I will present at the office of the above-mentioned telegraph company at this place, severally, at the times hereinafter mentioned, certain official communications from myself, in my official capacity, and addressed as specified, viz:

One communication will be presented at _____ o'clock — minutes — m., of _____ the _____ day of _____, 188 , addressed to _____.

One communication will be presented at _____ o'clock — minutes — m., of _____ the _____ day of _____, 188 , addressed to _____.

One communication will be presented at _____ o'clock — minutes — m., of _____ the _____ day of _____, 188 , addressed to _____.

I have the honor to request that the communications above referred to

may be received and transmitted telegraphically by the said company to their respective addresses at the times above mentioned, at which they will be severally presented for that purpose.

I am, sir, respectfully yours,

Sergeant, Signal Corps, U. S. A.

(3.) He will also record the time, place, and person, when, where, and to whom he delivered such notice, and reduce to writing any oral reply made or action taken. The record must be dated, timed, and made, plainly written, immediately after the service of the notice.

(4.) He will present his regular reports for transmission at the times and as directed in his schedule, at the telegraph offices, until further orders, whether or not the company has any employé then present whose usual duty it is to receive them. If the office is open for his admission, although closed for the transmission of messages, the communication should be presented to the most responsible person present in the employ of the company, a copy being always retained and record made as above directed. If the office appears to be closed, he will make himself sure of the fact that it is so.

(5.) In writing the message for transmission the observer will not use any form imposing terms of the limitations of a contract, but will write the communication tendered on the form directed by this Office.

(6.) He will keep a written record of the time when, place where, and the name of the person employed by the company to whom each communication was presented. In case the office was closed, so that the communication could not be presented to any employé of the company, he will record the time and place with the fact. If any employé of any telegraph company refuses to receive the message presented to him, it will be sufficient to have made the tender and to preserve such record as will establish the fact that it was made. The records in all cases must be dated and timed, and must be made, plainly written, immediately after the tender of the message. It should rehearse all facts which may tend to keep his memory of the transaction complete.

(7.) It is desirable, though not essential, that on some of the occasions when the above-mentioned notice is delivered, as well as when the message is tendered, the observer should, if practicable, take with him another person wholly disinterested, who may serve as an additional witness of the transaction.

(8.) Should the officer or employé in charge of the telegraph office inform the observer generally that he will not in the future be admitted to the office at all, he will not, on that account, discontinue giving notice or making tenders, but will give and make, or attempt to give and make, them precisely as before. The construction of the laws defining the relations of telegraph companies to the United States which is held by this Office is that the companies are bound to give unconditional priority to the telegraphic communications between the several departments of the Government of the United States, and between their officers and agents; that after due notice to that effect the companies are required to transmit such communications at any hour when they are tendered for that purpose, and that prepayment is not required from the government or its agents.

(9.) All the telegraph companies by which the messages of the Signal Service have hitherto been sent, according to directions given to the observers, have accepted the provisions of the act of Congress approved

July 24, 1866, a copy of which, and other acts bearing upon the subject, is hereto appended :

AN ACT to aid in the construction of telegraph-lines, and to secure to the Government the use of the same for postal, military and other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any telegraph company now organized, or which may hereafter be organized, under the laws of any State in this Union, shall have the right to construct, maintain, and operate lines of telegraph through and over any portion of the public domain of the United States, over and along any of the military or post roads of the United States, which have been or may hereafter be declared such by act of Congress, and over, under, or across the navigable streams or waters of the United States: *Provided,* That such lines of telegraph shall be so constructed and maintained as not to obstruct the navigation of such streams and waters, or interfere with the ordinary travel on such military or post roads. And any of said companies shall have the right to take and use from such public lands the necessary stone, timber, and other materials for its posts, piers, stations, and other needful uses in the construction, maintenance, and operation of said lines of telegraph, and may pre-empt and use such portion of the unoccupied public lands subject to pre-emption, through which its said lines of telegraph may be located, as may be necessary for its stations, not exceeding forty acres for each station; but such stations shall not be within fifteen miles of each other.

SEC. 2. *And be it further enacted,* That telegraphic communications between the several Departments of the Government of the United States and their officers and agents shall, in their transmission over the lines of said companies, have priority over all other business, and shall be sent at rates to be annually fixed by the Postmaster-General.

SEC. 3. *And be it further enacted,* That the rights and privileges hereby granted shall not be transferred by any company acting under this act to any other corporation, association, or person: *Provided, however,* That the United States may at any time after the expiration of five years from the date of the passage of this act, for postal, military, or other purposes, purchase all the telegraph-lines, property, and effects of any or all of said companies, at an appraised value, to be ascertained by five competent, disinterested persons, two of whom shall be selected by the Postmaster-General of the United States, two by the company interested, and one by the four so previously selected.

SEC. 4. *And be it further enacted,* That before any telegraph company shall exercise any of the powers or privileges conferred by this act, such company shall file their written acceptance with the Postmaster-General of the restrictions and obligations required by this act.

Approved, July 24, 1866.

[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION to authorize the Secretary of War to provide for taking meteorological observations at the military stations and at other points in the interior of the continent, and for giving notice on the northern lakes and seaboard of the approach and force of storms.

Be it resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be, and he hereby is, authorized and required to provide for taking meteor-

ological observations at the military stations in the interior of the continent, and at other points in the States and Territories of the United States, and for giving notice on the northern lakes and on the seacoast by magnetic telegraph and marine signals of the approach and force of storms.

Approved, February 9, 1870.

[General Orders, No. 18.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., July 3, 1872.

The following is the text of the order of the Secretary of War, received by the Chief Signal Officer of the Army, and is published for the information of all concerned:

“WAR DEPARTMENT,
“ *Washington City, June 27, 1872.*

“The Chief Signal Officer of the Army is hereby directed and ordered to carry into effect the special duties imposed upon the Secretary of War by the act of Congress approved July 24, 1866, entitled ‘An act to aid in the construction of telegraph-lines, and to secure to the government the use of the same for postal, military, and other purposes,’ and by the Public Resolution No. 9, approved February 9, 1870, and entitled ‘Joint Resolution to authorize the Secretary of War to provide for taking meteorological observations at the military stations and other points in the interior of the continent, and for giving notice on the northern lakes and seaboard of the approach and force of storms,’ and by the act approved June 10, 1872, entitled ‘An act making appropriations for sundry civil expenses of the government for the fiscal year ending June 30, 1873, and for other purposes’; and the said Chief Signal Officer of the Army, and all such persons as have been or shall be designated and employed by him for the taking of meteorological observations, or for preparing or presenting telegraphic communications for transmission, or for transmitting the same, as hereby recognized and appointed as agents of the War Department for those purposes; and are hereby authorized and directed by and in behalf of said department to offer to any telegraph company in the United States, for transmission, any and all such telegraph communications as they may be required by the Chief Signal Officer to make, and to request the transmission thereof by such company or companies, at such times, and in such places, as may be directed by said officer.

“WM. W. BELKNAP,
“ *Secretary of War.*”

By order of the Chief Signal Officer of the Army.

GARRICK MALLERY,
*Capt. and Bvt. Lieut. Col., U. S. A.,
Acting Signal Officer and Assistant.*

AN ACT making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, eighteen hundred and seventy-three, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated for the objects hereinafter ex-

pressed, for the fiscal year ending June thirtieth, eighteen hundred and seventy-three:

* * * * *

UNDER THE WAR DEPARTMENT.

* * * * *

SIGNAL-OFFICE.

For manufacture, purchase, or repair of meteorological and other necessary instruments; for telegraphing reports; for expenses of storm signals announcing probable approach and force of storms throughout the United States, for the benefit of commerce and agriculture; for instrument-shelters; for hire, furniture, and expenses of offices maintained for public use in cities or posts receiving reports; for maps and bulletins, to be displayed in chambers of commerce and boards-of-trade rooms; for books and stationery; and for incidental expenses not otherwise provided for, two hundred and fifty thousand dollars: *Provided*, That the Secretary of War be, and he hereby is, authorized and required to provide, in the system of observations and reports in charge of the Chief Signal Officer of the Army, for such stations, reports, and signals as may be found necessary for the benefit of agriculture and commercial interests: *And provided*, That no part of this appropriation, nor of any appropriation for the several Departments of the Government, shall be paid to any telegraphic company which shall neglect or refuse to transmit telegraphic communications between said Departments, their officers, agents, or employes, under the provisions of the second section of chapter two hundred and thirty of the Statutes of the United States for the year eighteen hundred and sixty-six, and at rates of compensation therefor to be established by the Postmaster-General: *Provided also*, That whenever any telegraph company shall have filed its written acceptance with the Postmaster-General, of the restrictions and obligations required by the act approved July twenty-fourth, eighteen hundred and sixty-six, entitled "An act to aid in the construction of telegraph-lines, and to secure to the Government the use of the same, for postal, military, and other purposes," if such company, its agents, or employes shall hereafter refuse or neglect to transmit any such telegraphic communications as are provided for by the aforesaid act or by the joint resolution approved the ninth day of February, eighteen hundred and seventy, "To authorize the Secretary of War to provide for taking meteorological observations at the military stations and other points of the interior of the continent, and for giving notice on the northern lakes and seaboard of the approach and force of storms," such telegraphic company shall forfeit and pay to the United States not less than one hundred and not exceeding one thousand dollars for each refusal or neglect aforesaid, to be recovered by an action or actions at law, in any district court of the United States.

Approved June 10, 1872.

[General Orders, No. 72.]

WAR DEPARTMENT,
ADJUTANT-GENERAL'S OFFICE,
Washington, June 30, 1874.

The following act of Congress is published for the information and government of all concerned :

AN ACT to protect lines of telegraph constructed or used by the United States from malicious injury and obstruction.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any person or persons who shall wilfully or maliciously injure or destroy any of the works or property or material of any telegraphic line constructed and owned, or in process of construction, by the United States, or that may be hereafter constructed and owned or occupied and controlled by the United States, or who shall wilfully or maliciously interfere in any way with the working or use of any such telegraphic line, or who shall wilfully or maliciously obstruct, hinder, or delay the transmission of any communication over any such telegraphic line, shall be deemed guilty of a misdemeanor, and, on conviction thereof in any district court of the United States having jurisdiction of the same, shall be punished by a fine of not less than one hundred nor more than one thousand dollars, or with imprisonment for a term not exceeding three years, or with both, in the discretion of the court.

Approved, June 23, 1874.

SPECIAL RIVER OBSERVATIONS.

Instructions for making and Reporting river Observations for the Signal Service United States Army.

308. All measurements at each station will be made from the bench-mark or water-level in common use by rivermen at that station, and the depth of water from the bed of the river to this level at the point where the gauge in use is located will be reported to this Office at the time of sending in the first mail reports.

309. When there is no established gauge in use at the station a cheap one may be constructed by the Observer, at the expense of this office, to be made of pine or oak timber, two inches thick by ten inches in width, and of sufficient length to cover the full range of the river between extreme low-water and high-water marks. This timber will be placed edgewise and firmly bedded in the earth, leaving one and a half inches of its width exposed above the level of the ground. The upper edge will be planed smooth, and carefully graduated in feet and inches, *after being placed in position*, taking the established bench-mark or level, referred to in paragraph 1, as the zero of the scale, and numbering the feet and inches, both above and below that point, unless it is at extreme low-water mark, in which case the numbers will all be above the zero of the scale. Especial pains will be taken in graduating the gauge to see that the distances marked off upon it for each foot and its subdivisions will correspond exactly to the vertical foot and subdivisions of which they are the measure. This can be readily done by means of an ordinary

spirit-level, a straight-edge, on which to place the level, and a graduated rod fixed vertically, from which to take the measurement.

310. Observations will be made daily throughout the year at — — m. local time, which corresponds with 2 p. m. Washington time, and transmitted by telegraph when ordered from this Office, or when rendered necessary by any sudden or unexpected change in the condition of the river. When such reports are sent, they must show, besides the depth of water at time of observation, the total change (either rise or fall) during the twenty-four hours immediately preceding. This information will be given by adding to the regular report the proper cipher word or words indicating this change, always placing them at the end of the regular report.

311. Whenever the rise or fall of water is gradual, the regular observation (made at — — m., local time, daily) will be sufficient. When any rise is sudden and unusual in its character, observations and reports should be made and telegraphed every three hours.

312. Observations will be made on Sundays at the regular hour, as on other days of the week.

313. All regular reports will be sent in the cipher accompanying these Instructions, in the manner explained in paragraphs 326 and 327. They will consist of five words each (besides the address and signature). When there has been no rainfall the word "naught" will be used to report the fact in the proper space. When the river is rising at the time of report, observers will use the cipher words in the column headed "Rise," and those in the column headed "Fall" when it is falling.

314. The amount of rain-fall in the last twenty-four hours will be measured as near the time of the river observation as practicable, and will be reported in the proper cipher words.

315. All reports will be written in duplicate on Form 203, and one copy filed, properly addressed and signed, at the telegraph office within thirty minutes after the observation is made. The report from will be addressed . The retained copies of all reports telegraphed during any one week will be mailed on the first day of the succeeding week to the "Chief Signal Officer, Washington, D. C."

316. The duplicate Forms 203 must be properly dated, timed, and signed, as indicated upon the forms, and must also show upon their face the time at which they were filed in the telegraph office.

317. A monthly report, on Form 114, will be made, the columns being filled up as indicated by the several headings on the form.

318. Stamps for prepayment of postage and all necessary blanks, forms, stationery, &c., will be furnished by this Office on requisition, and must not be purchased by observers without special authority from the Chief Signal Officer. Timely requisition should be made upon this Office for additional supplies whenever necessary.

319. All bills for services or materials furnished should be rendered *monthly*, and will be settled as soon after their receipt as the necessary vouchers can be signed, but authority must be obtained from this Office before contracting for same, except in cases of great emergency. The bill for construction of gauge will be settled promptly upon its receipt at this Office. Observers will not prepay telegrams or reports on official business, as settlement will be made by this Office with the telegraph companies direct.

320. Observers will arrange, as far as practicable, to have some competent, reliable person to make reports in case of their sickness or unavoidable absence; and when this is done, will see that the person so

employed is properly instructed in his duties. The names of persons so selected should be reported to this Office.

321. Special telegraphic reports will be made to this Office of the formation or breaking of all ice gorges or other obstructions in the river, and of the presence of floating ice or timber when of sufficient extent to render navigation unsafe, stating, in as few words as possible, the location and extent of the gorge, break, or obstruction in each instance.

322. It is expected that all observers will make their observations and reports *accurately* and *promptly*, bearing constantly in mind the fact that their usefulness when received at this Office depends wholly upon the fulfillment of these two conditions.

323. The Chief Signal Officer reserves to himself the right of withholding payment from any observer who shall neglect to make his reports accurately and promptly.

324. Whenever necessary, reports from adjoining stations will be sent to observers at special stations, and will be given by them to the press, and also posted in such public places as are most frequented by persons interested in the condition of the river.

325. Official communications by mail must be addressed "Chief Signal Officer of the Army, Washington, D. C.," by telegraph, "Signals Washington."

Instructions for the transmission of special river observations for the Signal Service, United States Army.

326. When water is above zero of gauge:

Each report will consist of eight words, address and signature included.

In the first space of the form used the word "Observer" or "Signals," as the case may be, will be written; in the second space the name of the place to which the report is to be telegraphed; in the third, the name of the station from which the report is made; in the fourth space, the cipher word for the date and time of report; in the fifth space, the one for state of weather and direction of wind; in the sixth space, the one for depth of water in inches; in the seventh space, the rain-fall; in the eighth, the surname of the observer. The word for date and time of report will be the one for the hour, Washington time, agreeing with the local time at which the observation is taken. The difference between local and Washington time will be furnished each observer by this Office. The cipher words must in all cases be written plainly and correctly.

Example.

FORM No. 203.]

WAR DEPARTMENT,
SIGNAL SERVICE, U. S. ARMY,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

Report of observation taken at Hermann, Mo., on April 1, at 1 p. m.

Observer.	Saint Louis.	Hermann.	Ugly.	Honest.
Schedule.	Rabbit.	Jones.	.....	.....

Handed to operator 1.20 p. m.

NOTE.—Operators will send only the matter inside the heavy lines

TRANSLATION.

Observer.... } Address of Signal Service observer at Saint Louis, Mo.
 Saint Louis.. }
 Hermann—Name of special river station at Hermann, Mo.
 Aback.. { Date of report..... First day of the month.
 { Time of observation, Washington time..... 2 o'clock p. m.
 Honest.. { State of weather..... Heavy rain.
 { Direction of wind..... Northwest.
 Schedule.. { Height of water above zero of gauge.. { 149 inches, or
 { River rising. { 12 feet 5 inches.

Rabbit—Amount of rain-fall, .01.

Jones—Name of river observer at Hermann.

When the water is rising the words will be taken from the columns headed "Rise"; when it is falling from the columns headed "Fall."

327. When water is below zero of gauge:

Example.

FORM No. 203.]

WAR DEPARTMENT,
 SIGNAL SERVICE, U. S. ARMY,
 DIVISION OF TELEGRAMS AND REPORTS FOR THE
 BENEFIT OF COMMERCE AND AGRICULTURE.

Report of observation taken at Helena, Ark., on April 2, at 12.05 p. m.

Signals.	Washington.	Helena.	Abash.	Hidden.
Mule.	Naught.	Smith.	.....	.....

Handed to operator 1.20 p. m.

NOTE.—Operators will send only the matter inside the heavy lines.

TRANSLATION.

Signals..... } Address of Chief Signal Officer, Washington, D. C.
 Washington.. }
 Helena—Name of special river station at Helena, Ark.
 Abash.. { Date..... Fifth day of the month.
 { Time of observation, Washington time .. 1 o'clock p. m.
 Hidden.. { State of weather..... Clear.
 { Direction of wind..... West.
 Mule..... { Height of water below zero of gauge..... 2 feet 11 inches.
 { River falling.

Naught—Amount of rainfall, none since last report.

Smith—Name of river observer at Helena.

328. The following cipher words will be used by observers at special river stations to encipher their reports for transmission by telegraph.

DATE AND LOCAL TIME OF REPORT.

(FOURTH SPACE IN FORM 203.)

Date.	3 p. m.	6 p. m.	9 p. m.	12 midnight.	3 a. m.	6 a. m.	9 a. m.	12 m.	1 p. m.	2 p. m.
1.....	Cad	Gab	Mace	Nag	Kafer	Idea	Pace	Sack	Abeck	Udy
2.....	Cake	Gage	Madge	Nail	Kale	Idiom	Peck	Sad	Abaft	Udra
3.....	Calf	Gain	Magt	Nash	Kalit	Idle	Pad	Safe	Abandon	Uhar
4.....	Cann	Gang	Main	Nave	Kamin	If	Pagan	Self	Abase	Ubld
5.....	Camp	Gang	Mate	Navy	Kaw	Iguite	Pago	Same	Abash	Ubnox
6.....	Cano	Gap	Mate	Nay	Kedge	Illex	Paint	Sample	Abash	Uncle
7.....	Cape	Gard	Man	Neal	Keen	Ilud	Pale	Sand	Abator	Uncut
8.....	Cary	Gas	Mark	Neap	Keep	Ilk	Pamp	Sash	Abbot	Undam
9.....	Cash	Gate	Max	Near	Keg	Image	Pasty	Sauce	Abduct	Under
10.....	Cash	Gaul	Maze	Neck	Kcal	Imagine	Panel	Saw	Abet	Undone
11.....	Cat	Gave	M. an	Ned	Kennel	Imbank	Pansy	Say	Abhor	Undue
12.....	Chew	Gay	Meek	Nero	Kennedy	Imbibe	Pardon	Scant	Abiding	Unfair
13.....	City	Gem	Meg	Nest	Kept	Imbow	Pass	Scale	Abject	Union
14.....	Clip	Get	Mend	New	Key	Imburse	Pause	Sense	Abjure	Unit
15.....	Coal	Gift	Met	Nice	Ketch	Imp	Paw	Send	Able	Unjust
16.....	Cob	Gild	Mine	Nick	Kick	In	Peace	Sex	Abode	Unjoin
17.....	Coke	Gin	Minx	Nigh	Kid	Incase	Peak	Shade	Unlike	Unlike
18.....	Gold	Gird	Moat	Nile	Kidder	Index	Peck	Shine	Abound	Unlive
19.....	Come	Give	Mob	Nip	Kill	India	Peg	Shrub	About	Unpay
20.....	Copy	Glad	Mood	Nip	Kilin	Indite	Pon	Sick	Above	Unpay
21.....	Cork	Glen	Mope	Nod	Kimbo	Indorse	Pelt	Side	Abridge	Unsafe
22.....	Cost	Go	Morn	Nook	Kind	Induce	Pike	Sick	Abroad	Unsay
23.....	Cox	Gone	Moss	Noon	King	Indulge	Pin	Sign	Abrupt	Until
24.....	Crab	Good	Moth	Nor	Kink	Infant	Pitch	Silk	Abcess	Up
25.....	Crow	Gray	Move	Nose	Kiss	Infer	Pitch	Sin	Abeced	Upas
26.....	Cry	Gryn	Mown	Not	Kite	Infer	Plant	Sing	Abeced	Upon
27.....	Cuba	Grub	Mud	Noun	Knave	Ink	Plain	Sink	Abesent	Upset
28.....	Cud	Gulf	Muff	Now	Knave	Ink	Plow	Skill	Abesist	Urge
29.....	Cup	Gun	Mugs	Nude	Kalfe	Insane	Plun	Skull	Abesorb	Urn
30.....	Cuff	Gust	Musk	Nut	Knock	Inso	Plug	Skunk	Abetain	Use
31.....	Cur	Guy	Myth	Nye	Know	Invoke	Push	Sling	Abstract	Usher

All cipher words must be written clearly and distinctly.

STATE OF WEATHER AND DIRECTION OF WIND.

(FIFTH SPACE IN FORM 203.)

State of weather.	Wind blowing from the—									
	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Calm.	
Clear.....	Habit	Hamper	Harden	Hasty	Head	Hellen	Hidden	Heard	Hops	
Foggy.....	Hable	Handle	Harlem	Hatch	Health	Helmet	High	Hobby	Hopper	
Smoke or haze.....	Hack	Harlot	Harlot	Hateful	Hear	Help	Hill	Hocus	Horn	
Fair.....	Hackney	Handsome	Harm	Hatched	Hearken	Hemlock	Himself	Holst	Horse	
Cloudy.....	Hat	Handy	Harmless	Haughty	Hearse	Hemp	Hinder	Hold	Hostage	
Clearing up.....	Haddock	Hang	Harness	Haul	Heart	Hence	Hinge	Holy	Hostile	
Threatening storm.....	Haggard	Hanker	Harpoon	Haunt	Heathen	Herald	Hint	Home	Hotel	
Light rain.....	Half	Happy	Harrow	Havoc	Heavy	Herb	Hip	Honest	Hound	
Heavy rain.....	Hall	Happen	Harry	Hawk	Hebrew	Herd	Hitch	Honey	House	
Light snow.....	Halloo	Harass	Harvest	Hay	Hector	Hermit	Hither	Honor	Howard	
Heavy snow.....	Halber	Harsh	Haste	Hazard	Hedge	Heron	Hive	Hood	Howlet	
Hail or sleet.....	Hammer	Harbor	Haze	Hazle	Height	Hester	Humble	Hood	Howling	
Thunder-storm.....	Hub	Huffy	Huge	Hulk	Hum	Human	Humble	Humbly	Humid	
Light rain.....	Humming	Humor	Hunger	Hungry	Hunt	Hunter	Hurl	Hurtful	Husband	
Heavy rain.....										

All cipher words must be written clearly and distinctly.

RIVER REPORT.

(SIXTH SPACE IN FORM 203.)

Surface of water below zero of gauge.

Rising.	(Inches.)	Falling.
1 Edgar		Juliet
2 Edmund		Laura
3 Edward		Lilly
4 Edwin		Louise
5 Ellis		Lucy
6 Elmer		Martha
7 Eugene		Mary
8 Felix		Matilda
9 Francis		Maud
10 Frank		Nancy
11 George		Nora
12 Henry		Olivia
13 Herbert		Pauline
14 Hiram		Phebe
15 Homer		Rachel
16 Horace		Rosa
17 Hugh		Ruth
18 Isaac		Sarah
19 Jacob		Sophia
20 James		Susan
21 Colorado		Cat
22 Delaware		Cow
23 Florida		Colt
24 Georgia		Calf
25 Indiana		Dog
26 Illinois		Duck
27 Iowa		Drake
28 Kansas		Goat
29 Kentucky		Goose
30 Maine		Hog
31 Michigan		Horse
32 Maryland		Kitten
33 Montana		Lamb
34 Nevada		Mouse
35 Ohio		Mule
36 Tennessee		Ox
37 Texas		Pig
38 Utah		Sheep
39 Vermont		Swan
40 Virginia		Turkey
41 Vial		Wacke
42 Void		Wad
43 Veal		Wade
44 Vile		Walrus
45 Vigor		Waltz
46 Vague		Wave

All cipher words must be written clearly and distinctly.

47 Vail	Want
48 Vain	War
49 Valid	Warm
50 Vamp	Wassail

(SIXTH SPACE IN FORM 203.)

RIVER REPORT.

0 to 42 inches above zero of gauge.

Rise.	Fall.
0 Sabal	Tab
1 Sabbath	Tabard
2 Sabine	Tabby
3 Sabre	Table
4 Sachem	Tablet
5 Sack	Tabling
6 Sacket	Taboo
7 Sackful	Taboret
8 Sacking	Tabular
9 Sackless	Tabulate
10 Sacrament	Tacit
11 Sacred	Tacker
12 Sacrifice	Tacking
13 Sacrilege	Tackle
14 Sad	Tact
15 Sadden	Tactics
16 Saddle	Taffy
17 Safe	Tag
18 Safeguard	Tailor
19 Safely	Taint
20 Safeness	Taintless
21 Safford	Tainture
22 Saffron	Take
23 Sage	Taking
24 Sagacious	Talent
25 Sagely	Tales
26 Sagging	Talk
27 Said	Talking
28 Sail	Taller
29 Sailing	Tallness
30 Sailor	Talon
31 Saintly	Talus
32 Sake	Tamarin
33 Salable	Tame
34 Sainted	Tameless
35 Saint	Tamely
36 Salad	Tamer
37 Salary	Tamp
38 Salem	Tamper
39 Salesman	Tamping
40 Salient	Tandem
41 Salina	Tangent
42 Salivate	Tangible

All cipher words must be written clearly and distinctly.

RIVER REPORT.

43 to 91 inches above zero of gauge.

Rise.	Fall.
43 Sallow	Tangle
44 Sally	Tangly
45 Salmon	Tangram
46 Saloon	Tanist
47 Salter	Tank
48 Salting	Tankard
49 Saltish	Tanner
50 Saltness	Tanning
51 Salty	Tansy
52 Salute	Tantamount
53 Saluda	Tape
54 Salvage	Taper
55 Salve	Tapestry
56 Salvia	Tapish
57 Salvor	Tardy
58 Sambo	Tare
59 Same	Target
60 Sameness	Targum
61 Samite	Tariff
62 Samlet	Tarnish
63 Sample	Tarry
64 Sampson	Tarsal
65 Sam	Tart
66 Samuel	Tartar
67 Sanborn	Tartish
68 Sanctum	Tartly
69 Sand	Tartness
70 Sandall	Task
71 Sanded	Tassel
72 Sanders	Taste
73 Sandford	Tasteful
74 Sandish	Tasteless
75 Sandwich	Tasting
76 Sandy	Tasty
77 Sane	Tatter
78 Saneness	Tattle
79 Sanguine	Tattoo
80 Sanity	Taught
81 Sap	Taunt
82 Saphire	Taunting
83 Sapient	Tavern
84 Sapless	Tawny
85 Sapling	Tax
86 Sapper	Taxable
87 Sappy	Taxation
88 Sarcasm	Taxless
89 Sardine	Tea
90 Sardonic	Teach
91 Sash	Teaching

All cipher words must be written clearly and distinctly.

RIVER REPORT.

92 to 140 inches above zero of gauge.

Rise.	Fall.
92 Satan	Teachless
93 Satanic	Team
94 Satchel	Teamster
95 Satisfate	Teapot
96 Satilla	Tear
97 Satinet	Tedious
98 Satire	Teeth
99 Satisfy	Telegram
100 Satrap	Telephone
101 Saturate	Tell
102 Saturday	Teller
103 Saturn	Telling
104 Sauce	Temperance
105 Saucepan	Temperate
106 Saucer	Tempest
107 Saucily	Templar
108 Saucy	Temple
109 Saul	Tempt
110 Saunter	Tenace
111 Sausage	Tenant
112 Savage	Tend
113 Savant	Tendance
114 Save	Tender
115 Saville	Tendril
116 Saving	Tendron
117 Savona	Tenement
118 Savor	Tennison
119 Savory	Tenor
120 Savoy	Tense
121 Sawfish	Tensely
122 Sawyer	Tensile
123 Saxon	Tension
124 Say	Tent
125 Saying	Tentful
126 Scab	Tenth
127 Scabbard	Tenting
128 Scaffold	Tenure
129 Scald	Tepid
130 Scale	Terapin
131 Scallop	Term
132 Scalp	Terminal
133 Scaly	Termless
134 Scamble	Terrell
135 Scamp	Terrible
136 Scamper	Terrify
137 Scandal	Terry
138 Scantling	Test
139 Scantly	Testable
140 Scape	Testament

All cipher words must be written clearly and distinctly.

RIVER REPORT.

141 to 189 inches above zero of gauge.

Rise.	Fall.
141 Scarce	Testate
142 Scarcely	Tester
143 Scare	Testify
144 Scarf	Testing
145 Scarlet	Tether
146 Scathe	Teuton
147 Scatter	Texas
148 Scene	Text
149 Schedule	Textile
150 Scheme	Texture
151 Scholar	Thaler
152 School	Than
153 Schooner	Thanks
154 Science	Thankful
155 Scoop	Thankless
156 Scorch	That
157 Scorn	Thatcher
158 Scornful	Thaw
159 Scottish	Thee
160 Scotland	Theatre
161 Scott	Theban
162 Scoundrel	Theft
163 Scour	Theme
164 Scourge	Then
165 Scout	Thence
166 Scouting	Theory
167 Scow	Therefor
168 Scowl	Therein
169 Scrambled	Thereof
170 Scrambling	Thermal
171 Scrap	Thesis
172 Scraper	They
173 Scraping	Thick
174 Scratch	Thicken
175 Scrawl	Thicket
176 Scream	Thickly
177 Screw	Thickness
178 Scribble	Thief
179 Scribbling	Thievish
180 Scribe	Thigh
181 Script	Thimble
182 Scripture	Thime
183 Scrivner	Thing
184 Scrofula	Think
185 Scroll	Thinker
186 Scrub	Thinking
187 Scrubbed	Thinly
188 Scrubby	Thinness
189 Scruple	Thinning

All cipher words must be written clearly and distinctly.

RIVER REPORT.

190 to 238 inches above zero of gauge.

Rise.	Fall.
190 Scrutiny	Third
191 Scuffle	Thirdly
192 Scully	Thirst
193 Sculpin	Thirsty
194 Sculptor	This
195 Sculpture	Thistle
196 Scum	Thither
197 Scurvy	Thomas
198 Scuttle	Thompson
199 Scythe	Thorn
200 Seaboard	Thorndike
201 Seaford	Thornton
202 Seal	Thorny
203 Seaman	Thorp
204 Seamless	Thorough
205 Seaside	Those
206 Season	Though
207 Seaton	Thought
208 Seaville	Thoughtful
209 Sebate	Thousand
210 Sebago	Thrall
211 Secede	Thralldom
212 Seclude	Thrash
213 Second	Thread
214 Secor	Threat
215 Secret	Threatful
216 Section	Thribble
217 Secular	Thrice
218 Secure	Thrift
219 Sedalia	Thrive
220 Sedan	Throat
221 Sedate	Throb
222 Sedge	Throne
223 Sedgewick	Throng
224 Sedition	Throttle
225 Seduce	Through
226 Seed	Thrum
227 Seeing	Thrust
228 Seek	Thud
229 Seeking	Thug
230 Seem	Thumb
231 Seeming	Thump
232 Seemly	Thunder
233 Segment	Thurl
234 Seize	ThurLOW
235 Seizure	Thurman
236 Selby	Thursday
237 Seldom	Thus
238 Select	Thwart

All cipher words must be written clearly and distinctly.

RIVER REPORT.

239 to 287 inches above zero of gauge.

Rise.	Fall.
239 Self	Thy
240 Selfish	Thyself
241 Sell	Ticket
242 Selma	Ticklish
243 Semblance	Tidal
244 Semble	Tide
245 Seminate	Tideless
246 Senate	Tidings
247 Senator	Tidy
248 Send	Tierce
249 Sending	Tiff
250 Seneca	Tiffany
251 Senior	Tiffin
252 Sense	Tifton
253 Senseless	Tiger
254 Sensible	Tight
255 Sensitive	Tighten
256 Sensor	Tightness
257 Sentence	Tigress
258 Sentiment	Tilden
259 Sentine	Tillage
260 Sentinel	Tilt
261 Sentry	Tilting
262 Separate	Tilson
263 Sepoy	Timber
264 September	Timid
265 Septic	Timothy
266 Sequence	Tin
267 Seraph	Tincture
268 Serenade	Tindall
269 Serene	Tinge
270 Serf	Tingley
271 Serfage	Tinker
272 Sergeant	Tinkle
273 Series	Tinman
274 Serious	Tinsel
275 Sermon	Tinsley
276 Serpent	Tinney
277 Serval	Tioga
278 Servant	Tip
279 Serve	Tipton
280 Service	Tipple
281 Survive	Tipsy
282 Serving	Tiptoe
283 Servitude	Tiptop
284 Session	Tirade
285 Set	Tiresome
286 Setter	Tisdale
287 Setting	Tissue

All cipher words must be written clearly and distinctly.

RIVER REPORT.

238 to 336 inches above zero of gauge.

Rise.	Fall.
288 Settle	Tither
289 Settlement	Tithly
290 Setler	Title
291 Setling	Titmouse
292 Seventh	Titular
293 Sever	Titus
294 Several	Toad
295 Severance	Toast
296 Sew	Toasting
297 Sewage	Tobacco
298 Sewell	To-day
299 Sewer	Together
300 Sewing	Toil
301 Sex	Toilet
302 Sextant	Toilful
303 Sextile	Toiling
304 Sexton	Toilsome
305 Shabby	Token
306 Shackle	Told
307 Shad	Toleston
308 Shaddock	Tolerate
309 Shading	Tom
310 Shadow	Tomato
311 Shady	Tomb
312 Shaft	Tombless
313 Shaggy	Tomboy
314 Shake	Tompkins
315 Shaken	Tone
316 Shall	Toneless
317 Shallow	Tongs
318 Shamble	Tongue
319 Shambling	Tonic
320 Shame	Tonnage
321 Shameful	Tonsil
322 Shameless	Tontine
323 Shamois	Took
324 Shanghai	Tool
325 Shanks	Topaz
326 Shannon	Topic
327 Shanty	Topless
328 Shape	Topmast
329 Shapeless	Topping
330 Share	Torch
331 Sharp	Torment
332 Sharpen	Tornado
333 Sharply	Torpedo
334 Sharpness	Torpent
335 Shatter	Torpid
336 Shaver	Torrent

All cipher words must be written clearly and distinctly.

RIVER REPORT.

337 to 385 inches above zero of gauge.

Rise.	Fall.
337 Shaving	Torrid
338 Shaw	Torsion
339 Shawl	Tortive
340 Shawnee	Tortoise
341 She	Torture
342 Sheaf	Tory
343 Shear	Toss
344 Shearing	Tossing
345 Sheathe	Total
346 Sheathing	Touch
347 Sheathless	Touching
348 Shedding	Tough
349 Sheep	Toughly
350 Sheepish	Toughness
351 Sheepy	Tour
352 Sheet	Tournament
353 Shelburne	Tow
354 Shelby	Towage
355 Sheldon	Towanda
356 Shelf	Towards
357 Shell	Towing
358 Shellac	Towel
359 Shelling	Tower
360 Shelly	Townsend
361 Shelter	Town
362 Shelve	Township
363 Shelving	Townsmen
364 Shepherd	Towser
365 Sheridan	Toy
366 Sheriff	Toyful
367 Sherman	Toyish
368 Sherry	Toyman
369 Sherwood	Trace
370 Shield	Tracer
371 Shielding	Tracing
372 Shiftless	Track
373 Shilling	Trackless
374 Shiloh	Tracy
375 Shindle	Trade
376 Shine	Tradesman
377 Shingle	Tradition
378 Shining	Traduce
379 Ship	Traffic
380 Shipman	Tragedy
381 Shipment	Tragic
382 Shipping	Trail
383 Shirley	Train
384 Shirt	Trait
385 Shirtless	Traitor

All cipher words must be written clearly and distinctly.

RIVER REPORT.

386 to 433 inches above zero of gauge.

Rise.	Fall.
386 Shiver	Trammel
387 Shoal	Tramp
388 Shock	Trample
389 Shocking	Tramway
390 Shoddy	Trance
391 Shoe	Tranquil
392 Shoeless	Transact
393 Shoot	Transcend
394 Shooting	Transcribe
395 Shoreless	Transcript
396 Shorn	Transfer
397 Shorten	Transfix
398 Shortly	Transform
399 Shortness	Transgress
400 Should	Tranship
401 Shoulder	Transient
402 Shout	Transit
403 Shouting	Translate
404 Shovel	Transmit
405 Shower	Transom
406 Showing	Transpire
407 Showman	Transplant
408 Showy	Transport
409 Shred	Transpose
410 Shrewd	Trap
411 Shrewdly	Trapeze
412 Shrewdness	Trapper
413 Shrill	Trappings
414 Shrink	Trash
415 Shrinkage	Travel
416 Shroud	Traverse
417 Shroudless	Tray
418 Shrub	Treachery
419 Shrubby	Treading
420 Shrubless	Treason
421 Shrug	Treasure
422 Shrunk	Treasury
423 Shuck	Treat
424 Shucking	Treatise
425 Shudder	Treatment
426 Shuffle	Treaty
427 Shuffling	Treble
428 Shumac	Tree.
429 Shun	Trellis.
430 Shunt	Tremble.
431 Shunting	Tremont
432 Shut	Tremor
433 Shuttle	Trench

All cipher words must be written clearly and distinctly.

RIVER REPORT.

434 to 432 inches above zero of gauge.

Rise.	Fall.
434 Shy	Trend
435 Shyness	Trenton
436 Siam	Trespass
437 Sibley	Trestle
438 Sicily	Trial
439 Sicken	Tribe
440 Sickish	Tribunal
441 Sickly	Tribune
442 Sickly	Tribute
443 Sickness	Trickster
444 Siddons	Trifle
445 Side	Trigger
446 Siding	Trill
447 Sidney	Trillion
448 Siege	Trimley
449 Sieve	Trimmer
450 Sift	Trimming
451 Sifter	Trinity
452 Sigel	Triplet
453 Sigh	Tripod
454 Sighing	Triumph
455 Sight	Trivial
456 Sightful	Trojan
457 Sightless	Trombone
458 Sightly	Troop
459 Sigma	Trophy
460 Sign	Tropic
461 Signal	Trot
462 Signature	Trouble
463 Signers	Trousers
464 Signet	Trout
465 Signify	Trowel
466 Sikes	Truage
467 Silence	Truant
468 Silent	Trudge
469 Silently	True
470 Silex	Trumbull
471 Silk	Truman
472 Silky	Trumpet
473 Sillon	Trundle
474 Silver	Trunk
475 Similar	Trusion
476 Simmer	Truss
477 Simmons	Trustee
478 Simon	Trustful
479 Simper	Truth
480 Simplex	Truthful
481 Simpleton	Truthless
482 Simplify	Truxton

All cipher words must be written clearly and distinctly.

RIVER REPORT.

483 to 531 inches above zero of gauge.

Rise.	Fall.
483 Simply	Trying
484 Simulate	Tub
485 Sin	Tubing
486 Since	Tuft
487 Sincere	Tulip
488 Sindon	Tumble
489 Sinclair	Tumid
490 Sinecure	Tumor
491 Sinew	Tumult
492 Sinful	Tune
493 Sing	Tuneful
494 Singer	Tuneless
495 Single	Tunnel
496 Singly	Turban
497 Singular	Turf
498 Sinister	Turfless
499 Sink	Turk
500 Sinless	Turkey
501 Sinner	Turn
502 Sinnet	Turmoil
503 Sinuate	Turner
504 Sioux	Turning
505 Sipping	Turnip
506 Siphon	Turret
507 Sipid	Turtle
508 Sippet	Tuscan
509 Sisson	Tussock
510 Sister	Tutor
511 Sitka	Twain
512 Situate	Twelfth
513 Sixpence	Twice
514 Sixth	Twig
515 Size	Twilight
516 Skate	Twin
517 Skein	Twist
518 Skeleton	Ugly
519 Skeptic	Ulan
520 Sketch	Ulcer
521 Skiff	Ultimate
522 Skillful	Ultimo
523 Skill	Ultra
524 Skilled	Umber
525 Skillet	Umbrage
526 Skimming	Umpire
527 Skimmer	Unable
528 Skipper	Unarm
529 Skirmish	Unbar
530 Skulk	Unbend
531 Skulking	Unbias

All cipher words must be written clearly and distinctly.

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RIVER REPORT.

532 to 580 inches above zero of gauge.

Rise.	Fall.
532 Skull	Unbid
533 Skylark	Unbind
534 Skyward	Unblest
535 Slacken	Unbolt
536 Slackness	Unborn
537 Slander	Unbound
538 Slang	Unbrace
539 Slant	Uncap
540 Slash	Uncase
541 Slate	Unchain
542 Slating	Unclass
543 Slaughter	Uncle
544 Slave	Unclean
545 Slavery	Unclog
546 Slavish	Uncork
547 Slay	Uncouth
548 Sled	Uncover
549 Sledge	Uncurl
550 Sleep	Under
551 Sleepful	Undid
552 Sleeping	Undo
553 Sleepless	Undone
554 Sleepy	Undraw
555 Sleet	Undress
556 Sleeve	Undue
557 Sleighing	Uneasy
558 Slender	Unfair
559 Slew	Unfit
560 Slice	Unfold
561 Slide	Unfurl
562 Slight	Unhappy
563 Slip	Unhurt
564 Sloop	Uniform
565 Slumber	Union
566 Sly	Unison
567 Smack	Unite
568 Small	Unity
569 Smart	Unjoin
570 Smell	Unjust
571 Smile	Unkind
572 Smith	Unknown
573 Smoke	Unlace
574 Smooth	Unless
575 Snail	Unload
576 Snake	Unlock
577 Snow	Unmanly
578 Snuff	Unmask
579 Soda	Unripe
580 Solder	Unroll

All cipher words must be written clearly and distinctly.

RIVER REPORT.

581 to 629 inches above zero of gauge.

Rise.	Fall.
581 Soon	Unruly
582 Sorrow	Unsafe
583 South	Unsay
584 Space	Unsound
585 Spain	Untie
586 Spangle	Untold
587 Spanish	Untrue
588 Spark	Unwell
589 Speed	Upset
590 Splice	Upton
591 Sponge	Urchin
592 Spread	Urge
593 Spring	Usage
594 Spruce	Useful
595 Square	Usher
596 Squint	Usual
597 Stage	Usurp
598 Stamp	Utmost
599 Stand	Utter
600 Starch	Ubi
601 Stab	Uber
602 Stable	Udder
603 Stack	Ukase
604 Staff	Ullage
605 Staid	Ulnar
606 Stain	Umbel
607 Stair	Umbra
608 Stake	Umbrel
609 Stalk	Unapt
610 Stall	Unbay
611 Stamen	Unbit
612 Stammer	Undock
613 Stanch	Unmoor
614 Stang	Unmove
615 Stank	Unnerve
616 Staple	Unoil
617 Star	Unown
618 Stare	Unpart
619 Stark	Unpave
620 Start	Unpay
621 Starve	Unpen
622 State	Unravel
623 Static	Unread
624 Station	Uncap
625 Statist	Unrig
626 Statue	Unright
627 Stave	Unring
628 Stays	Unriot
629 Stead	Unroot

All cipher words must be written clearly and distinctly.

RIVER REPORT.

630 to 679 inches above zero of gauge.

Rise.	Fall.
630 Steal	Unsaid
631 Steam	Unseat
632 Steane	Unseen
633 Steel	Unset
634 Steep	Unsex
635 Steer	Unshame
636 Steg	Unshape
637 Stella	Unsheath
638 Stem	Unship
639 Stench	Unshod
640 Stent	Unshook
641 Step	Unshorn
642 Stere	Unshot
643 Sterile	Unshrunk
644 Stern	Unshut
645 Steve	Unsoft
646 Stew	Unsold
647 Steward	Unsoot
648 Stibal	Unsown
649 Stick	Unspeak
650 Stiff	Unsped
651 Stiffen	Unspent
652 Stiffness	Unspied
653 Stife	Unsplit
654 Stigh	Unspot
655 Stigma	Unstaid
656 Stile	Unstate
657 Still	Unstop
658 Stime	Unswear
659 Sting	Untack
660 Stinger	Untaint
661 Stink	Untame
662 Stint	Untaste
663 Stipe	Untax
664 Stipend	Unteach
665 Stipple	Untent
666 Stiptic	Until
667 Stir	Unto
668 Stirk	Untomb
669 Stirp	Untried
670 Stitch	Untrod
671 Stive	Untruss
672 Stoak	Untune
673 Stocade	Untwine
674 Stock	Untwist
675 Stocking	Unuse
676 Stoic	Unusual
677 Stoke	Unvail
678 Stoll	Unvex
679 Stomach	Unvote

All cipher words must be clearly and distinctly written.

RIVER REPORT.

680 to 720 inches above zero of gange.

Rise.	Fall.
680 Stone	Unwarp
681 Stood	Unwary
682 Stool	Unwash
683 Stoop	Unwed
684 Stoor	Unwept
685 Stopper	Unwet
686 Stoppie	Unwield
687 Storage	Unwind
688 Store	Unwise
689 Storial	Unwound
690 Stork	Unwrap
691 Storm	Unwrung
692 Story	Unyoke
693 Stot	Unzone
694 Stound	Upbear
695 Stour	Upbraid
696 Stout	Upgrow
697 Stove	Upheave
698 Stow	Uphold
699 Straddle	Upland
700 Straggle	Uplay
701 Straight	Upled
702 Strain	Uplift
703 Strait	Uplook
704 Strake	Upon
705 Strand	Upper
706 Strange	Uprear
707 Strangle	Upright
708 Strap	Uprise
709 Strata	Uproar
710 Strategy	Upshot
711 Strategem	Upstart
712 Stratum	Upstear
713 Straw	Upstrain
714 Stray	Upturn
715 Streak	Upward
716 Stream	Upwind
717 Street	Urbane
718 Strength	Urea
719 Stress	Ursa
720 Stretch	Usure

All cipher words must be written clearly and distinctly.

(LAST WORD IN FORM 203.)

RAIN-FALL SINCE LAST REPORT.

.01 to .49 inches.

* Johnson
 .01 Rabbit
 .02 Rabble
 .03 Raccoon
 .04 Race
 .05 Racer
 .06 Rack
 .07 Racket
 .08 Racy
 .09 Raddock
 .10 Radiant
 .11 Radiate
 .12 Radical
 .13 Radish
 .14 Radius
 .15 Raffle
 .16 Raft
 .17 Rafting
 .18 Rag
 .19 Rage
 .20 Rageful
 .21 Ragged
 .22 Ragman
 .23 Raid
 .24 Rail
 .25 Railing
 .26 Rain
 .27 Rainbow
 .28 Rainless
 .29 Rainy
 .30 Raise
 .31 Raisin
 .32 Rake
 .33 Raking
 .34 Rally
 .35 Ramage
 .36 Ramble
 .37 Rampage
 .38 Rampant
 .39 Ramrod
 .40 Ramson
 .41 Ranche
 .42 Rancid
 .43 Rancor
 .44 Random
 .45 Range
 .46 Ranger
 .47 Rank
 .48 Rankness
 .49 Ransack

.50 to .99 inches.

.50 Rap
 .51 Rapid
 .52 Rapine
 .53 Rapture
 .54 Rascal
 .55 Rash
 .56 Rashly
 .57 Rashness
 .58 Rat
 .59 Rather
 .60 Ratify
 .61 Ratio
 .62 Ration
 .63 Rattle
 .64 Ravage
 .65 Ravel
 .66 Raven
 .67 Ravish
 .68 Rawley
 .69 Raymond
 .70 Razor
 .71 Reaching
 .72 Read
 .73 Reading
 .74 Ready
 .75 Really
 .76 Ream
 .77 Reap
 .78 Rear
 .79 Reason
 .80 Rebate
 .81 Rebel
 .82 Rebound
 .83 Rebuff
 .84 Rebuild
 .85 Rebuke
 .86 Rebut
 .87 Recall
 .88 Recast
 .89 Recede
 .90 Receipt
 .91 Receive
 .92 Recent
 .93 Reception
 .94 Recess
 .95 Rechange
 .96 Recite
 .97 Reckless
 .98 Reckon
 .99 Reclaim

All cipher words must be written clearly and distinctly.

* This word must be inserted in the telegram when rain has fallen since the last report but the amount found in the gauge is less than .01 of an inch.

RAIN-FALL SINCE LAST REPORT.

1.00 to 1.49 inches.

{ .00 Reclasp
 .01 Recline
 .02 Reclining
 .03 Recluse
 .04 Recoil
 .05 Record
 .06 Recount
 .07 Recourse
 .08 Recover
 .09 Recruit
 .10 Rector
 .11 Recur
 .12 Recusant
 .13 Red
 .14 Redden
 .15 Redeem
 .16 Redoubt
 .17 Redound
 .18 Redraw
 .19 Redress
 .20 Reduce
 .21 Reed
 .22 Reef
 .23 Refer
 1 { .24 Refill
 .25 Refine
 .26 Reft
 .27 Reflect
 .28 Refloat
 .29 Reflux
 .30 Refold
 .31 Reforge
 .32 Reform
 .33 Refrain
 .34 Refresh
 .35 Refuge
 .36 Refund
 .37 Refusal
 .38 Refuse
 .39 Refute
 .40 Regain
 .41 Regal
 .42 Regard
 .43 Regatta
 .44 Regent
 .45 Regiment
 .46 Region
 .47 Register
 .48 Regrade
 { .49 Regret

1.50 to 1.99 inches.

{ .50 Regular
 .51 Regulate
 .52 Rehash
 .53 Rehearse
 .54 Reject
 .55 Rejoice
 .56 Rejoin
 .57 Rejudge
 .58 Relapse
 .59 Relate
 .60 Relation
 .61 Relative
 .62 Relator
 .63 Relax
 .64 Relaying
 .65 Release
 .66 Relent
 .67 Relenting
 .68 Reliance
 .69 Relic
 .70 Relief
 .71 Relieve
 .72 Religion
 .73 Relish
 1 { .74 Reload
 .75 Reluctant
 .76 Rely
 .77 Remade
 .78 Remain
 .79 Remake
 .80 Remand
 .81 Remark
 .82 Remedy
 .83 Remember
 .84 Reminder
 .85 Remiss
 .86 Remit
 .87 Remnant
 .88 Remodel
 .89 Remold
 .90 Remorse
 .91 Remote
 .92 Remotely
 .93 Remount
 .94 Removal
 .95 Remove
 .96 Render
 .97 Renerve
 .98 Renew
 { .99 Rennet

 All cipher words must be written clearly and distinctly.

RAIN-FALL SINCE LAST REPORT.

2.00 to 2.49 inches.	2.50 to 2.99 inches.
{ .00 Renown	{ .50 Resort
.01 Rent	.51 Resound
.02 Rental	.52 Resource
.03 Replace	.53 Respect
.04 Repack	.54 Respite
.05 Repaint	.55 Respond
.06 Repair	.56 Response
.07 Repast	.57 Rest
.08 Repay	.58 Restful
.09 Repeal	.59 Resting
.10 Repeater	.60 Restless
.11 Repel	.61 Restore
.12 Repent	.62 Restrain
.13 Repine	.63 Restrict
.14 Replace	.64 Result
.15 Replant	.65 Resume
.16 Repleat	.66 Retail
.17 Repleven	.67 Retainer
.18 Replevy	.68 Retake
.19 Replunge	.69 Retard
.20 Reply	.70 Retire
.21 Report	.71 Retort
.22 Reposal	.72 Retouch
.23 Repose	.73 Retrace
2 { .24 Repress	2 { .74 Retreat
.25 Reprieve	.75 Retrench
.26 Reprint	.76 Retrieve
.27 Reproach	.77 Return
.28 Reproof	.78 Reunion
.29 Reprove	.79 Reveal
.30 Reptile	.80 Revenge
.31 Repugn	.81 Revenue
.32 Repulse	.82 Reverse
.33 Repute	.83 Revert
.34 Request	.84 Review
.35 Require	.85 Revince
.36 Rescind	.86 Revise
.37 Rescue	.87 Revival
.38 Research	.88 Revive
.39 Resend	.89 Revoke
.40 Reserve	.90 Revolt
.41 Reset	.91 Revolve
.42 Reship	.92 Rewake
.43 Reside	.93 Reward
.44 Resident	.94 Rhubarb
.45 Resign	.95 Ribbon
.46 Resin	.96 Rich
.47 Resist	.97 Richly
.48 Resolute	.98 Richness
{ .49 Resolve	{ .99 Rickets

All cipher words must be written clearly and distinctly.

RAIN-FALL SINCE LAST REPORT.

3.00 to 3.49 inches.

- 3 {
- .00 Riddance
 - .01 Riddle
 - .02 Ride
 - .03 Ridge
 - .04 Riding
 - .05 Rife
 - .06 Rifle
 - .07 Riggs
 - .08 Rigging
 - .09 Right
 - .10 Rightful
 - .11 Rigid
 - .12 Rigor
 - .13 Ripple
 - .14 Ring
 - .15 Ringlet
 - .16 Rinse
 - .17 Riot
 - .18 Ripen
 - .19 Ripley
 - .20 Ripple
 - .21 Rise
 - .22 Risk
 - .23 Rival
 - .24 River
 - .25 Roach
 - .26 Roadway
 - .27 Roaming
 - .28 Roars
 - .29 Roast
 - .30 Roasting
 - .31 Robbery
 - .32 Robin
 - .33 Robe
 - .34 Robert
 - .35 Robust
 - .36 Rocky
 - .37 Roddy
 - .38 Rogers
 - .39 Rogue
 - .40 Roll
 - .41 Rolling
 - .42 Roman
 - .43 Romance
 - .44 Roof
 - .45 Root
 - .46 Rope
 - .47 Rosary
 - .48 Rosette
 - .49 Rosland

3.50 to 4.00 inches.

- 3 {
- .50 Ross
 - .51 Roster
 - .52 Rostrum
 - .53 Rosy
 - .54 Rotary
 - .55 Rotate
 - .56 Rotten
 - .57 Rotunda
 - .58 Rough
 - .59 Roughly
 - .60 Round
 - .61 Rouse
 - .62 Rousing
 - .63 Route
 - .64 Routine
 - .65 Roving
 - .66 Row
 - .67 Rowdy
 - .68 Royal
 - .69 Rub
 - .70 Rubbage
 - .71 Rubber
 - .72 Rubbing
 - .73 Rubbish
 - .74 Ruby
 - .75 Rudder
 - .76 Rude
 - .77 Rudeness
 - .78 Ruffian
 - .79 Rufus
 - .80 Rugged
 - .81 Ruinous
 - .82 Rule
 - .83 Ruling
 - .84 Rummage
 - .85 Rumor
 - .86 Rumpus
 - .87 Run
 - .88 Running
 - .89 Ruption
 - .90 Rural
 - .91 Rusking
 - .92 Russell
 - .93 Russia
 - .94 Rust
 - .95 Rustic
 - .96 Rusty
 - .97 Ruth
 - .98 Rutland
 - .99 Rutter

* 4.00 Rutledge.

All cipher words must be written clearly and distinctly.

* When the amounts of rain-fall since the last report exceeds four inches, two or more words must be used to express it in the telegram.

LOCATION OF BENCH-MARKS.

329. The following statement shows the location of the bench-marks from which the rise and fall of rivers in the United States are measured for the river-reports of this Office:

Albany, Oreg.—The zero of gauge is low water of 1877, but extreme low water was 5 inches below this in 1875.

Augusta, Ga.—The zero of the gauge is low-water mark of 1835. In 1839, the river fell 6 inches below this mark, but the zero of the gauge was not changed.

Boonville, Mo.—The zero of the river-gauge is placed at the low-water mark of January, 1872, and readings show the depth of water above that point. The depth of water from the zero to the bed rock of river is 19 or 20 feet.

Brownsville, Pa.—The zero-point of the gauge is fixed at the depth of water in the channel on June 5, 1873, which was 5 feet.

Brunswick, Mo.—The zero of gauge is low water of 1876, or 31 feet 3 inches below high water of 1844.

Cairo, Ill.—The zero of gauge is placed at low water of October, 1871, which is one foot above low water of December 24, 1871, the lowest water known. Extreme high water occurred in 1867, when it reached the top of the levee, which is 50.97 feet on the gauge or 51.97 feet above low-water mark. The bench-mark is the top of the levee.

Chattanooga, Tenn.—The zero of gauge is placed at the lowest water mark known, the date of which is not given, and is 60 feet below the highest water known, viz, the flood of 1867.

Cincinnati, Ohio.—The bench-mark and zero of gauge is twenty inches above the bottom of the river—extreme low water. The high-water mark is a point 65 feet 5 inches above the bench-mark. Extreme high water occurred March 7, 1865, and extreme low water September 15, 1858.

Colusa, Cal.—The zero of gauge is low water of 1875.

Confluence, Pa.—Depth of river at low-water mark, 12 inches; zero of gauge at low-water mark.

Davenport, Iowa.—The gauge was constructed by Colonel Macomb, United States Engineers, on the pivot of the draw-bridge pier of the government bridge between Davenport and Rock Island. It is in the Davenport channel, and is cut in the stone-work and painted in black and graduated into feet and tenths. Its zero-point is the low water of 1863.

Decatur, Ala.—The zero of gauge is low-water mark of 1865, and is the bench-mark all river men go by.

Dubuque Iowa.—The gauge at this station is located at the foot of 7th street. Its zero-point is low-water mark of October, 1864, which is 21 feet 10 inches below the high-water mark of April 22, 1870. The depth of water from the zero of the gauge to the bed of the river is 17 feet.

Eugene City, Oreg.—The zero of gauge is 11 feet above the bed of river and is as near low-water mark as can be ascertained.

Evansville, Ind.—The zero of the gauge is placed at low-water mark of 1867, being 6 feet above the bed of the river. A survey made at 3 p. m. April 19, 1873, gave depth of water above low-water mark (1867) 25 feet 4 inches.

Folsom City, Cal.—The zero of the gauge was placed at surface of the water when the river was very low. Does not refer to low water of any particular year. 42 feet on this gauge is highest water mark (Dec. 19, 1862).

Fort Smith, Ark.—The zero of gauge is placed at extreme low water of 1856, which is 7 feet above the bed of the river.

Freeport, Pa.—The bench-mark is 4 feet above average low-water mark. Zero of gauge fixed at average low water.

Helena, Ark.—Zero of gauge fixed at 2.20 feet above low-water mark of 1872.

Hermann, Mo.—The zero of gauge is fixed at low-water mark of January, 1874, which is 27.50 feet below high water of 1844.

Jefferson City, Mo.—Reports are made from low water of 1867 and high water of 1844, the river in 1844 being 31 feet higher than low water of 1867. Depth of water, at date of first Signal Service observation, May 12, 1873, at 3 p. m., 10 feet 10 inches above low-water mark.

Johnsonville, Tenn.—The zero of gauge is 20 inches above low-water mark of 1874. The height of gauge is 45 feet 2 inches to high-water mark of the spring of 1875.

Kansas City, Mo.—Low-water mark was established at the zero of the gauge by the chief engineer Missouri River Bridge Company, in 1867. High-water mark is that of 1844.

Keokuk, Iowa.—Zero of gauge fixed at low water of 1873.

La Crosse, Wis.—The zero of the gauge is low-water mark of October, 1872. Depth of water below zero is 5 feet. On August 26, 1877, the river fell 2 feet 3 inches below the zero.

Le Claire, Iowa.—The gauge used here was built by the Pilot Association in 1863; its bottom (zero-point) is at the extreme low-water mark of 1864, which indicates 21 inches of water on the rapids.

Leavenworth, Kans.—The zero of gauge fixed at low-water mark of November 27, 1871, on the 13th of March, 1875, and the readings from that date correspond with those made at Fort Leavenworth.

Lexington, Mo.—The zero of gauge is at low-water mark of 1861, being 10 feet 8 inches above the bed of the river. Depth of water in river opposite to gauge, according to measurement made May 15, 1873, was 17 feet 10 inches.

Little Rock, Ark.—The bottom of gauge is marked 2 feet, and when the water is at that mark there is 2 feet of water in the river. All river men go by this mark, and the same is reported to the Packet Company at Memphis and Saint Louis.

Louisville, Ky.—The zero is the sill of the lock of the Louisville and Portland Canal. The bench-mark is the door-sill of house corner of Tenth and Water streets, and is 28.1 feet above zero. Extreme high water of February 21, 1832, is 41.8 feet above zero. The depth of water is taken from a gauge at the foot of Tenth street, and is used by all river men. When the water in the river is higher than can be measured by this gauge, a gauge located under the Ohio and Mississippi Railroad bridge is used. There is no mark that gives the depth of channel.

Marietta, Ohio.—The zero of gauge corresponds with the bottom of Duck Creek bar.

Marysville, Cal.—The bottom and zero of gauge rests on the bed of the river and is scaled from that point to the floor of the bridge, a height of 15 feet.

Memphis, Tenn.—The gauge used was constructed by the United States Engineer Corps; is located at the foot of Jefferson street, and its zero placed at a point eleven inches above low water of December 25, 1872. Eleven inches are added to each observation to make it agree with low water of that date.

Morgantown, W. Va.—The gauge rests upon the bed of the river, and reports indicate the exact depth of the water in the channel.

Muscatine, Iowa.—Zero of gauge fixed at low-water mark, 1864 and 1872.

Nashville, Tenn.—The bench-mark is 62.75 feet above the zero of gauge. The zero corresponds to extreme low water. Bench-mark 23.25 feet above highest water since Nashville has been a signal station. No definite data as to years of high and low water can be obtained.

New Geneva, Pa.—The gauge rests upon the bottom of the river, and reports indicate the exact depth of water. The highest water occurred in April, 1852, when there was 40 feet of water in the channel.

New Orleans, La.—The zero of gauge was changed September 9, 1874 to agree with high-water mark of 1874, which occurred April 15 and 16, 1874. On September 1, 1879, readings were commenced from a newly-constructed gauge. It was found that, owing to gradual settlement of the wharf, the old gauge read 1 foot too low.

Oil City, Pa.—The gauge is located opposite the rapids, and the zero-mark is $1\frac{1}{2}$ feet above the bottom of the channel; $1\frac{1}{2}$ feet on this gauge is equal to $1\frac{1}{2}$ feet of water on "Charlie's Riffle," the shallowest place between here and Pittsburgh. This corresponds with the gauge generally used by river men.

Omaha, Nebr.—The gauge is at the foot of Farman street, and was constructed by the United States Engineer Corps, and its zero is 2 feet above the low water-mark of 1867. The high-water mark of the same year is 17 feet above zero of gauge. Two feet are added to the readings.

Oroville, Cal.—The zero of gauge is placed at water-level of October 17, 1878, which is considered as low as ever known here, and is 28 feet below high-water mark, date of which is not given.

Paducah, Ky.—The zero of the gauge is placed at low-water mark of 1857.

Pittsburgh, Pa.—The reports show the actual depth of water in the channel.

Plattsmouth, Nebr.—Zero of gauge placed at low water of 1873.

Portland, Oreg.—The zero of the gauge is .1 foot above low water of January 3, 1879. There is a slight tide in the river, but the readings of the gauge are not corrected for tide.

Red Bluff, Cal.—The zero of the gauge is at low water of November, 1876, but in the fall of 1877 and 1878 the river was about 3 inches below that point.

Saint Joseph, Mo.—The zero of gauge is at low-water mark of 1871. Depth of water from the river bed to the zero of gauge is 8 feet. The navigable depth of water in the channel is 4 feet. Usual depth on bars and shoals during low water is about 3 or 4 feet. From bed-rock to zero of the gauge at Saint Joseph, as per the bridge measurement, is 50 feet.

Saint Louis, Mo.—Readings are made from the United States Engineer's gauge, foot of Market street. The bench-marks are extreme low water of 1863 and high water of 1844. The range of gauge between these two points is 41.39 feet.

Saint Paul, Minn.—The bench-mark and zero of gauge is directly opposite the Northern Packet Line Company's wharf boat, and is marked at extreme low water of 1861. The daily report of river is the depth of water above that mark. The depth of water in the channel at Pig Eye bar at extreme low water is 1 foot 11 inches. There is no high-water mark of any reliability.

Shreveport, La.—The bench-mark is on Commerce street, adjoining the "transfer grounds" of the Texas Pacific Railroad. The lowest-water mark, 1872, the reference point in reporting depth of river, is in the bed of river, and 40 feet below high water of 1849, and 25 feet above bottom of the river. From bottom of river to high-water mark of 1849 is 65 feet. On February 15, 1880, the zero of the gauge was

placed at low water of 1879, which makes the gauge read 3 feet 6 inches higher than before.

Umatilla, Oreg.—The zero of gauge is low water of March, 1874.

Vicksburg, Miss.—The river gauge is attached to one of the posts which support the elevator located on the levee between Crawford and South streets, and its zero is low-water mark of 1871. From it all measurements are made, and the zero of the gauge is adjusted to it. Extreme high water of 1862 is 52.9 feet above the bench-mark. The river bed is 50 feet 6 inches below, making the depth of water in the channel, when the river is at high-water mark, 103 feet 3 inches. The river in front of the city having filled in from ten to fifteen feet in consequence of the cut-off, the gauge is unserviceable, and readings are taken from a temporary gauge constructed at Ryan's mills, the zero of which is at the same water-level as that of the one at the elevator.

Warsaw, Ill.—Zero of gauge fixed at low-water mark of 1873.

Yankton, Dak.—The bed of the river is the zero point of the gauge, and the actual depth of water in the channel is reported.

DEW POINT AND RELATIVE HUMIDITY TABLES.

330. (1.) Tables I-V give the temperature of the dew point for the actual pressures 30.00, 27.00, 24.00, 21.00 and 18.00 inches. The vertical argument, as given in the left-hand column of each page, is the temperature of the air or the reading of the exposed or dry-bulb thermometer (t). The horizontal argument, as given at the top of each page, is the depression of the wet bulb thermometer (t') or the difference ($t-t'$) between the readings of the dry and wet bulb thermometers.

(2.) The actual barometric pressure at the station will determine which of Tables I-V is to be used; select always the table for the nearest actual pressure. The supplementary tables on pp. 3, 5, 9, 11, 15 and 17 will be used for the few cases to which they are applicable. Bold face type indicates the points at which the wet bulb begins to be covered with ice.

(3.) Table VI gives the relative humidity for all pressures. The vertical argument is the temperature of the air (t). The horizontal argument is the depression of the dew point (d) or the difference ($t-d$) between the readings of the exposed thermometer and the dew point; the latter will be obtained from the preceding Tables I-V.

EXAMPLES.

(4.) Actual pressure 27.36 in., the exposed thermometer reads 57° F., the wet bulb thermometer 48° F. Find the temperature of the dew point and the relative humidity.

Air temperature, (t) = 57°
 Wet bulb reading, (t') = 48°
 Depression of the wet bulb, ($t-t'$) = 9°
 From Table II, for 27.0 in. we obtain dew point, (d) = 38° .
 Depression of the dew point, ($t-d$) = 19°
 From Table VI we obtain relative humidity, = 49 p. ct.

(5.) Actual pressure 28.20 in., the exposed thermometer reads 26° , the wet bulb thermometer 19° . Find the temperature of the dew point and relative humidity.

Air temperature, (t) = 26°
 Wet bulb reading, (t') = 19°
 Depression of the wet bulb, ($t-t'$) = 7°
 Dew point, (d) = -9° by Table I, for 28.0 in.
 Depression of the dew point, ($t-d$) = 35°
 Relative humidity, = 20 p. ct. by Table VI.

TABLE I.

DEW POINT.

Barometric pressure, 30.0 inches.

Air temp.	Depression of the wet-bulb thermometer (t-t').													Air temp.	
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
Barometric pressure, 29.0 inches.															
-20°	-20						t	4							-20°
19	19						11	21							19
18	18						12	18							18
17	17						13	14							17
-16	-16						14	-12	-28						-16
-15	-15	-31					15	23	23						-15
14	14	29					16	21	6	7	8	9	t		14
13	13	27					17	17							13
12	12	26					18	13							12
-11	-11	24					19	-10	-27					+19	-11
-10	-10	-23					+20		21					20	-10
9	9	21							17					21	9
8	8	19							13					22	8
7	7	18							6	-25				23	7
-6	-6	16							15	19				24	-6
-5	-5	-15	-31						12	15				25	-5
4	4	13	29						-8	12				26	4
3	3	12	26							-23				27	3
2	2	11	23							17				28	2
-1	-1	-9	-21							12			-25	29	-1
0	0	-8	-19							-9				+30	0
+1	+1	6	17							7	8	9	t		+1
2	2	5	15												2
3	3	4	13	-30											3
4	4	-3	-12	-26											4
Barometric pressure, 28.0 inches.															
+5	+5	-1	-10	-23			t	4							+5
6	6	0	8	21			+10	-21							6
7	7	+1	7	18			11	19							7
8	8	2	5	15			12	16							8
9	9	3	-4	-13	-29		13	13	5						9
+10	+10	+5	-2	-11	-26		14	-11	-24						+10
11	11	6	0	9	23		15	21	18						11
12	12	7	+1	7	20		16	18	6	7	8	9	t		12
13	13	8	2	5	16		17	14	11					+19	13
14	14	9	4	-3	-14	-31	18	11	-9					20	14
+15	+15	+11	+6	-1	-11	-26	19		-23					21	+15
16	16	12	7	0	9	23	+20		18					22	16
17	17	13	8	+2	6	19			14					23	17
18	18	14	9	4	4	15	t	4	5					24	18
19	19	15	11	5	-2	-12	-31		-8	-22				25	19
+20	+20	+16	+12	+7	0	-9			6	18				26	+20
21	21	17	13	9	+2	6	-24	19		-6	-19			27	21
22	22	19	15	10	4	4	15	15			14			28	22
23	23	20	16	12	6	-1	11	-29	-29		10			29	23
24	24	21	17	13	8	+1	-8	-23	-23		-6	-20	+30	30	24
+25	+25	+22	+18	+15	+9	+3	-5	-18							+25
26	26	23	20	16	11	5	-2	14							26
27	27	24	21	17	13	7	0	10	-27		7	8	9	t	27
28	28	25	22	18	14	9	+3	6	20						28
29	29	26	23	20	16	11	5	-3	-15						29
+30	+30	+27	+21	+24	+17	+13	+7	-1	-11	-30					+30
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE I.

DEW POINT.

Barometric pressure, 30.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').													Air temp. t	
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
+30°	+30°	+27°	+24°	+21°	+17°	+13°	+7°	-1°	-11°	-30°					+30°
31	31	28	25	22	18	14	9	+2	-7	-23					31
32	32	29	26	23	20	16	11	+5	-3	-17					32
33	33	30	27	24	21	17	13	7	-1	-12	-82				33
34	34	31	28	25	22	19	15	9	+2	-7	-23				34
+35	+35	+32	+29	+26	+24	+20	+16	+11	+5	-3	-17				+35
36	36	33	30	27	24	21	18	13	8	-1	-12	-82			36
37	37	34	32	29	25	21	19	15	9	+3	-7	-23			37
38	38	35	33	30	26	23	19	17	12	6	-3	-16			38
39	39	36	34	31	28	24	20	16	14	8	0	-11	-31		39
+40	+40	+37	+35	+32	+29	+26	+22	+18	+12	+10	+3	-6	-22		40
41	41	39	36	33	30	27	23	19	14	8	6	-2	-15		41
42	42	40	37	34	31	28	25	21	16	10	3	+2	-9	-29	42
43	43	41	38	35	33	30	26	22	18	13	6	-3	-5	-20	43
44	44	42	39	37	34	31	27	24	20	15	9	+1	-12	-13	44
+45	+45	+43	+40	+38	+35	+32	+29	+25	+21	+17	+11	+4	-7	-27	45
46	46	44	41	39	36	33	30	27	23	19	14	7	-2	-18	46
47	47	45	43	40	37	35	32	28	25	21	16	10	+2	-11	47
48	48	46	44	41	39	36	33	30	26	22	18	12	5	-6	48
49	49	47	45	42	40	37	34	31	28	24	20	15	8	-1	49
+50	+50	+48	+46	+43	+41	+38	+36	+33	+29	+26	+22	+17	+11	+3	+50
51	51	49	47	45	42	40	37	34	31	27	23	19	13	6	51
52	52	50	48	46	43	41	38	35	32	29	25	21	16	9	52
53	53	51	49	47	44	42	40	37	34	30	27	23	18	12	53
54	54	52	50	48	46	43	41	38	35	32	28	24	20	15	54
+55	+55	+53	+51	+49	+47	+45	+42	+39	+36	+33	+30	+26	+22	+17	+55
56	56	54	52	50	48	46	43	41	38	35	32	28	24	19	56
57	57	55	53	51	49	47	45	42	39	36	33	30	26	22	57
58	58	56	54	52	50	48	46	43	41	38	35	31	28	24	58
59	59	57	55	53	51	49	47	45	42	39	36	33	29	26	59
+60	+60	+58	+56	+54	+52	+50	+48	+46	+43	+41	+38	+35	+31	+28	+60
61	61	59	57	56	54	52	49	47	45	42	39	36	33	29	61
62	62	60	58	57	55	53	51	48	46	43	41	38	35	31	62
63	63	61	60	58	56	54	52	50	47	45	42	39	36	33	63
64	64	62	61	59	57	55	53	51	49	46	44	41	38	35	64
+65	+65	+63	+62	+60	+58	+56	+54	+52	+50	+48	+45	+42	+39	+36	+65
66	66	64	63	61	59	57	55	53	51	49	46	44	41	38	66
67	67	65	64	62	60	58	56	54	52	50	48	45	43	40	67
68	68	66	65	63	61	59	58	56	54	51	49	47	44	41	68
69	69	67	66	64	62	61	59	57	55	53	50	48	45	43	69
+70	+70	+68	+67	+65	+63	+62	+60	+58	+56	+54	+52	+49	+47	+44	+70
71	71	69	68	66	65	63	61	59	57	55	53	51	48	46	71
72	72	71	69	67	66	64	62	60	58	56	54	52	50	47	72
73	73	72	70	68	67	65	63	61	60	58	56	53	51	49	73
74	74	73	71	69	68	66	64	63	61	59	57	55	52	50	74
+75	+75	+74	+72	+70	+69	+67	+65	+64	+62	+60	+58	+56	+54	+51	+75
76	76	75	73	71	70	68	67	65	63	61	59	57	55	53	76
77	77	76	74	72	71	69	68	66	64	62	60	58	56	54	77
78	78	77	75	74	72	70	69	67	65	64	62	60	58	55	78
79	79	78	76	75	73	71	70	68	66	65	63	61	59	57	79
+80	+80	+79	+77	+76	+74	+73	+71	+69	+68	+66	+64	+62	+60	+58	+80
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE I.

DEW POINT.

Barometric pressure, 30.0 inches.

Air temp.	Depression of the wet-bulb thermometer (t-t').														Air temp.
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
+ 80	+ 80	+ 79	+ 77	+ 76	+ 74	+ 73	+ 71	+ 69	+ 68	+ 66	+ 64	+ 62	+ 60	+ 58	+ 80
81	81	80	78	77	75	74	72	70	69	67	65	63	61	60	81
82	82	81	79	78	76	75	73	72	70	68	66	65	63	61	82
83	83	82	80	79	77	76	74	73	71	69	68	66	64	62	83
84	84	83	81	80	78	77	75	74	72	70	69	67	65	63	84
+ 85	+ 85	+ 84	+ 82	+ 81	+ 79	+ 78	+ 76	+ 75	+ 73	+ 72	+ 70	+ 68	+ 66	+ 65	+ 85
86	86	85	83	82	80	79	77	76	74	73	71	69	68	66	86
87	87	86	84	83	81	80	79	77	75	74	72	70	69	67	87
88	88	87	85	84	82	81	80	78	77	75	73	72	70	68	88
89	89	88	86	85	84	82	81	79	78	76	75	73	71	69	89
+ 90	+ 90	+ 89	+ 87	+ 86	+ 85	+ 83	+ 82	+ 80	+ 79	+ 77	+ 76	+ 74	+ 72	+ 71	+ 90
91	91	90	88	87	86	84	83	81	80	78	77	75	74	72	91
92	92	91	89	88	87	85	84	82	81	79	78	76	75	73	92
93	93	92	90	89	88	86	85	83	82	81	79	77	76	74	93
94	94	93	91	90	89	87	86	85	83	82	80	79	77	75	94
+ 95	+ 95	+ 94	+ 92	+ 91	+ 90	+ 88	+ 87	+ 86	+ 84	+ 83	+ 81	+ 80	+ 78	+ 77	+ 95
96	96	95	93	92	91	89	88	87	85	84	82	81	79	78	96
97	97	96	94	93	92	90	89	88	86	85	83	82	80	79	97
98	98	97	95	94	93	92	90	89	87	86	85	83	82	80	98
99	99	98	96	95	94	93	91	90	88	87	86	84	83	81	99
+100	+100	+ 99	+ 97	+ 96	+ 95	+ 94	+ 92	+ 91	+ 90	+ 88	+ 87	+ 85	+ 84	+ 82	+100
101	101	100	98	97	96	95	93	92	91	89	88	86	85	83	101
102	102	101	99	98	97	96	94	93	92	90	89	87	86	85	102
103	103	102	100	99	98	97	95	94	93	91	90	89	87	86	103
104	104	103	101	100	99	98	96	95	94	92	91	90	88	87	104
+105		+104	+103	+101	+100	+ 99	+ 97	+ 96	+ 95	+ 94	+ 92	+ 91	+ 89	+ 88	+105
106			104	102	101	100	98	97	96	95	93	92	90	89	106
107				103	102	101	100	98	97	96	94	93	92	90	107
108					102	101	100	98	97	96	95	94	93	91	108
109					103	102	100	99	98	96	96	95	94	92	109
+110							+103	+101	+100	+ 99	+ 97	+ 96	+ 95	+ 93	+110
111								102	101	100	99	97	96	95	111
112									102	101	100	98	97	96	112
113										102	101	99	98	97	113
114											102	100	99	98	114
+115												+101	+100	+ 99	+115
116													101	100	116
117														101	117
118															118
119															119
+120															+120
121															121
122															122
123															123
124															124
+125															+125
126															126
127															127
128															128
129															129
+130															+130
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

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TABLE I.

DEW POINT.

Barometric pressure, 30.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').															Air temp. t
	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
+ 80	+ 58	+ 56	+ 54	+ 51	+ 49	+ 46	+ 43	+ 40	+ 37	+ 36	+ 29	+ 24	+ 18	+ 11	+ 80	
81	60	57	55	53	50	48	45	42	39	35	31	27	21	15	81	
82	61	59	57	54	52	49	47	44	41	37	34	29	24	19	82	
83	62	60	58	56	53	51	48	46	43	39	36	31	27	22	83	
84	63	61	59	57	55	53	50	47	44	41	38	34	30	25	84	
+ 85	+ 65	+ 63	+ 61	+ 59	+ 56	+ 54	+ 52	+ 49	+ 46	+ 43	+ 40	+ 36	+ 32	+ 28	+ 85	
86	66	64	62	60	58	55	53	51	48	45	42	38	34	30	86	
87	67	65	63	61	59	57	55	52	50	47	44	40	37	33	87	
88	68	66	65	63	60	58	56	54	51	49	46	42	39	35	88	
89	69	68	66	64	61	60	58	55	53	50	47	44	41	38	89	
+ 90	+ 71	+ 69	+ 67	+ 65	+ 63	+ 61	+ 59	+ 57	+ 54	+ 52	+ 49	+ 46	+ 43	+ 40	+ 90	
91	72	70	68	66	65	63	60	58	56	54	51	48	45	42	91	
92	73	71	70	68	66	64	62	60	57	55	52	50	47	44	92	
93	74	73	71	69	67	65	63	61	59	57	54	52	49	46	93	
94	75	74	72	70	68	67	65	63	60	58	56	53	51	48	94	
+ 95	+ 77	+ 75	+ 73	+ 72	+ 69	+ 68	+ 66	+ 64	+ 62	+ 60	+ 57	+ 55	+ 52	+ 50	+ 95	
96	78	76	74	73	71	69	67	65	63	61	59	56	54	51	96	
97	79	77	76	74	72	70	69	67	65	63	60	58	56	53	97	
98	80	78	77	75	73	72	70	68	66	64	62	60	57	55	98	
99	81	80	78	76	75	73	71	69	67	65	63	61	59	56	99	
+ 100	+ 82	+ 81	+ 79	+ 78	+ 76	+ 74	+ 72	+ 71	+ 69	+ 67	+ 65	+ 63	+ 60	+ 58	+ 100	
101	83	82	80	79	77	75	74	72	70	68	66	64	62	60	101	
102	85	83	81	80	78	77	75	73	71	69	68	66	64	61	102	
103	86	84	83	81	80	78	76	74	73	71	69	67	65	63	103	
104	87	85	84	82	81	79	77	76	74	72	70	68	66	64	104	
+ 105	+ 88	+ 86	+ 85	+ 83	+ 82	+ 80	+ 79	+ 77	+ 75	+ 73	+ 72	+ 70	+ 68	+ 66	+ 105	
106	89	88	86	85	83	82	80	78	77	75	73	71	69	67	106	
107	90	89	87	86	84	83	81	80	78	76	74	72	71	69	107	
108	91	90	88	87	85	84	82	81	79	77	76	74	72	70	108	
109	92	91	90	88	87	85	84	82	80	79	77	75	73	71	109	
+ 110	+ 93	+ 92	+ 91	+ 89	+ 88	+ 86	+ 85	+ 83	+ 82	+ 80	+ 78	+ 76	+ 75	+ 73	+ 110	
111	95	93	92	90	89	87	86	84	83	81	80	78	76	74	111	
112	96	94	93	91	90	89	87	86	84	82	81	79	77	76	112	
113	97	95	94	93	91	90	88	87	85	84	82	80	79	77	113	
114	98	96	95	94	92	91	89	88	86	85	83	82	80	78	114	
+ 115	+ 99	+ 98	+ 96	+ 95	+ 93	+ 92	+ 91	+ 89	+ 88	+ 86	+ 84	+ 83	+ 81	+ 79	+ 115	
116	100	99	97	96	95	93	92	90	89	87	86	84	83	81	116	
117	101	100	98	97	96	94	93	91	90	88	87	85	84	82	117	
118		101	99	98	97	95	94	93	91	90	88	87	85	83	118	
119			101	99	98	97	95	94	92	91	89	88	86	85	119	
+ 120				+ 100	+ 99	+ 98	+ 96	+ 95	+ 93	+ 92	+ 90	+ 89	+ 87	+ 86	+ 120	
121					100		97	96	95	93	92	90	89	87	121	
122						100	98	97	96	94	93	91	90	88	122	
123							100	98	97	95	94	93	91	89	123	
124								99	98	97	95	94	92	91	124	
+ 125									+ 99	+ 98	+ 96	+ 95	+ 93	+ 92	+ 125	
126										99	97	96	95	93	126	
127											99	97	96	94	127	
128												98	97	96	128	
129													98	97	129	
+ 130														98	+ 130	
	13	14	15	16	17	18	19	20	21	22	23	24	25	26		

TABLE I.

DEW POINT.

Barometric pressure, 30.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
+ 80	+11	- 3	-29												+ 80
81	15	+ 4	13												81
82	19	10	- 3	-27											82
83	22	14	+ 5	11											83
84	25	18	11	- 2	-25										84
+ 85	+28	+22	+15	+ 6	-10										+ 85
86	30	25	19	12	0	-23									86
87	33	28	22	15	+ 7	- 8									87
88	35	30	26	20	13	+ 1	-20								88
89	38	33	28	23	17	8	- 6								89
+ 90	+40	+36	+31	+26	+21	+13	+ 3	-17							+ 90
91	42	38	34	29	24	18	9	- 4							91
92	44	40	36	32	27	22	14	+ 4	-14						92
93	46	43	39	35	30	25	19	11	- 2	-29					93
94	48	45	41	37	33	28	23	16	+ 6	-10					94
+ 95	+50	+47	+43	+40	+36	+31	+26	+20	+12	0	-24				+ 95
96	51	49	45	42	38	34	29	24	17	+ 8	- 7				96
97	53	50	47	44	41	37	32	27	21	14	+ 3	-18			97
98	55	52	49	46	43	39	35	30	25	19	10	- 4			98
99	56	54	51	48	45	42	38	33	28	23	15	+ 5	-13		99
+ 100	+58	+56	+53	+50	+47	+44	+40	+36	+31	+26	+20	+12	- 1	-30	+100
101	60	57	55	52	49	46	43	39	34	29	24	17	+ 7	- 9	101
102	61	59	57	54	51	48	45	41	37	33	28	22	14	+ 3	102
103	63	61	58	56	53	50	47	44	40	36	31	25	19	10	103
104	64	62	60	57	55	52	49	46	42	39	34	29	23	16	104
+ 105	+66	+64	+62	+59	+57	+54	+51	+48	+45	+41	+37	+32	+27	+21	+105
106	67	65	63	61	58	56	53	50	47	44	40	35	30	25	106
107	69	67	65	62	60	58	55	52	49	46	42	38	34	28	107
108	70	68	66	64	62	59	57	54	51	48	45	41	37	32	108
109	71	70	68	66	63	61	58	56	53	50	47	43	39	35	109
+ 110	+73	+71	+69	+67	+65	+63	+60	+58	+55	+52	+49	+46	+42	+38	+110
111	74	73	71	69	67	64	62	60	57	54	51	48	45	41	111
112	76	74	72	70	68	66	64	61	59	56	53	50	47	43	112
113	77	75	73	72	70	67	65	63	61	58	55	52	49	46	113
114	78	77	75	73	71	69	67	65	62	60	57	54	51	48	114
+ 115	+79	+78	+76	+74	+72	+70	+68	+66	+64	+62	+59	+56	+54	+51	+115
116	81	79	77	76	74	72	70	68	66	63	61	58	56	53	116
117	82	81	79	77	75	73	71	69	67	65	63	60	58	55	117
118	83	82	80	78	77	75	73	71	69	67	64	62	59	57	118
119	85	83	81	80	78	76	74	72	70	68	66	64	61	59	119
+ 120	+86	+85	+83	+81	+79	+78	+76	+74	+72	+70	+68	+65	+63	+61	+120
121	87	86	84	82	81	79	77	75	73	71	69	67	65	62	121
122	88	87	85	84	82	80	79	77	75	73	71	69	66	64	122
123	89	88	87	85	83	82	80	78	76	74	72	70	68	66	123
124	91	89	88	86	85	83	81	79	78	76	74	72	70	67	124
+ 125	+92	+91	+89	+87	+86	+84	+83	+81	+79	+77	+75	+73	+71	+69	+125
126	93	92	90	89	87	86	84	82	80	79	77	75	73	71	126
127	94	93	92	90	88	87	85	84	82	80	78	76	74	72	127
128	96	94	93	91	90	88	86	85	83	81	80	78	76	74	128
129	97	96	94	92	91	89	88	86	85	83	81	79	77	75	129
+ 130	+98	+97	+95	+94	+92	+91	+89	+87	+86	+84	+82	+81	+79	+77	+130
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	

TABLE II.

DEW POINT.

Barometric pressure, 27.0 inches.

[illegible]

TABLE II.

DEW POINT.

Barometric pressure, 27.0 inches.

Air temp.	Depression of the wet-bulb thermometer (t-t').													Air temp.	
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
+30	+30	+27	+25	+22	+18	+15	+10	+4	-4	-15					+30
31	31	28	26	23	20	16	11	6	-1	11	-27				31
32	32	29	27	24	21	17	13	8	+2	7	20				32
33	33	30	28	25	22	19	15	10	4	-4	15				33
34	34	31	29	26	24	20	16	12	6	0	-10	-26			34
+35	+35	+32	+30	+27	+25	+21	+18	+14	+8	+2	-6	-20			+35
36	36	34	31	28	25	23	19	16	11	5	-3	14			36
37	37	35	32	29	26	23	21	17	13	7	0	9	-26		37
38	38	36	33	30	27	24	20	19	15	10	+4	5	19		38
39	39	37	34	31	28	25	22	18	16	12	6	-2	-13		39
+40	+40	+38	+35	+32	+30	+27	+23	+19	+15	+14	+8	+2	-8	-23	+40
41	41	39	36	34	31	28	25	21	17	12	11	5	-4	16	41
42	42	40	37	35	32	29	26	23	19	14	8	0	0	11	42
43	43	41	38	36	33	30	27	24	20	16	10	4	+3	6	43
44	44	42	40	37	34	32	29	25	22	18	13	6	-3	-2	44
+45	+45	+43	+41	+38	+36	+33	+30	+27	+23	+20	+15	+9	+1	-10	+45
46	46	44	42	39	37	34	31	28	25	21	17	12	5	-5	46
47	47	45	43	40	38	36	33	30	26	23	19	14	8	0	47
48	48	46	44	42	39	37	34	31	28	24	21	16	10	+3	48
49	49	47	45	43	40	38	35	32	29	26	22	18	13	6	49
+50	+50	+48	+46	+44	+42	+39	+36	+34	+31	+27	+24	+20	+15	+9	+50
51	51	49	47	45	43	40	38	35	32	29	26	22	17	12	51
52	52	50	48	46	44	42	39	36	34	30	27	24	19	14	52
53	53	51	49	47	45	43	40	38	35	32	29	25	21	17	53
54	54	52	50	48	46	44	42	39	36	33	30	27	23	19	54
+55	+55	+53	+51	+49	+47	+45	+43	+40	+38	+35	+32	+29	+25	+21	+55
56	56	54	52	50	48	46	44	42	39	36	33	30	27	23	56
57	57	55	53	52	50	47	45	43	40	38	35	32	28	25	57
58	58	56	54	53	51	49	46	44	42	39	36	33	30	27	58
59	59	57	55	54	52	50	48	45	43	40	38	35	32	28	59
+60	+60	+58	+56	+55	+53	+51	+49	+47	+44	+42	+39	+36	+33	+30	+60
61	61	59	58	56	54	52	50	48	46	43	41	38	35	32	61
62	62	60	59	57	55	53	51	49	47	45	42	39	36	33	62
63	63	61	60	58	56	54	52	50	48	46	43	41	38	35	63
64	64	62	61	59	57	55	54	52	49	47	45	42	40	37	64
+65	+65	+63	+62	+60	+58	+56	+55	+53	+50	+48	+46	+44	+41	+38	+65
66	66	64	63	61	59	58	56	54	52	50	47	45	43	40	66
67	67	65	64	62	60	59	57	55	53	51	49	46	44	41	67
68	68	66	65	63	62	60	58	56	54	52	50	48	45	43	68
69	69	68	66	64	63	61	59	57	55	53	51	49	47	44	69
+70	+70	+69	+67	+65	+64	+62	+60	+58	+56	+55	+53	+50	+48	+46	+70
71	71	70	68	66	65	63	61	60	58	56	54	52	50	47	71
72	72	71	69	67	66	64	62	61	59	57	55	53	51	49	72
73	73	72	70	68	67	65	64	62	60	58	56	54	52	50	73
74	74	73	71	70	68	66	65	63	61	59	58	56	54	51	74
+75	+75	+74	+72	+71	+69	+67	+66	+64	+62	+61	+59	+57	+55	+53	+75
76	76	75	73	72	70	69	67	65	64	62	60	58	56	54	76
77	77	76	74	73	71	70	68	66	65	63	61	59	57	55	77
78	78	77	75	74	72	71	69	68	66	64	62	60	58	57	78
79	79	78	76	75	73	72	70	69	67	65	64	62	60	58	79
+80	+80	+79	+77	+76	+74	+73	+71	+70	+68	+66	+65	+63	+61	+59	+80
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE II.

DEW POINT.

Barometric pressure, 27.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
+80	+80	+79	+77	+76	+74	+73	+71	+70	+68	+66	+65	+63	+61	+59	+80
81	81	80	78	77	75	74	72	71	69	68	66	64	62	60	81
82	82	81	79	78	76	75	73	72	70	69	67	65	64	62	82
83	83	82	80	79	77	76	74	73	71	70	68	66	65	63	83
84	84	83	81	80	78	77	76	74	72	71	69	68	66	64	84
+85	+85	+84	+82	+81	+80	+78	+77	+75	+74	+72	+70	+69	+67	+65	+85
86	86	85	83	82	81	79	78	76	75	73	72	70	68	67	86
87	87	86	84	83	82	80	79	77	76	74	73	71	69	68	87
88	88	87	85	84	83	81	80	78	77	75	74	72	71	69	88
89	89	88	86	85	84	82	81	79	78	76	75	73	72	70	89
+90	+90	+89	+87	+86	+85	+83	+82	+80	+79	+78	+76	+74	+73	+71	+90
91	91	90	88	87	86	84	83	82	80	79	77	76	74	72	91
92	92	91	89	88	87	85	84	83	81	80	78	77	75	74	92
93	93	92	90	89	88	86	85	84	82	81	79	78	76	75	93
94	94	93	91	90	89	88	86	85	83	82	80	79	78	76	94
+95	+95	+94	+92	+91	+90	+89	+87	+86	+84	+83	+82	+80	+79	+77	+95
96	96	95	94	92	91	90	88	87	86	84	83	81	80	78	96
97	97	96	95	93	92	91	89	88	87	85	84	82	81	79	97
98	98	97	96	94	93	92	90	89	88	86	85	84	82	80	98
99	99	98	97	95	94	93	91	90	89	87	86	85	83	82	99
+100	+100	+99	+98	+96	+95	+94	+92	+91	+90	+88	+87	+86	+84	+83	+100
101	101	100	99	97	96	95	93	92	91	90	88	87	85	84	101
102	102	101	100	98	97	96	94	93	92	91	89	88	86	85	102
103	103	102	101	99	98	97	96	94	93	92	90	89	88	86	103
104	104	103	102	100	99	98	97	95	94	93	91	90	89	87	104
+105	+104		+103	+101	+100	+99	+98	+96	+95	+94	+92	+91	+90	+88	+105
106			104	102	101	100	99	97	96	95	94	92	91	89	106
107				103	102	101	100	98	97	96	95	93	92	90	107
108					103	102	101	99	98	97	96	94	93	92	108
109						103	102	100	99	98	97	95	94	93	109
+110							+103	+102	+100	+99	+98	+96	+95	+94	+110
111								103	101	100	99	98	96	95	111
112									102	101	100	99	97	96	112
113										102	101	100	98	97	113
114											102	101	99	98	114
+115												+102	+100	+99	+115
116													102	101	116
117															117
118															118
119															119
+120															+120
121															121
122															122
123															123
124															124
+125															+125
126															126
127															127
128															128
129															129
+130															+130
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE II.

DEW POINT.

Barometric pressure, 27.0 inches.

Air temp.	Depression of the wet-bulb thermometer ($t-t'$).															Air temp.
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	t	
+ 80	+ 59	+ 57	+ 55	+ 53	+ 51	+ 48	+ 46	+ 43	+ 40	+ 37	+ 33	+ 29	+ 24	19	+ 80	
81	60	58	56	54	52	50	47	44	42	38	35	31	27	22	81	
82	62	60	58	56	53	51	49	46	43	40	37	34	29	25	82	
83	63	61	59	57	55	53	50	48	45	42	39	36	32	28	83	
84	64	62	60	58	56	54	52	49	47	44	41	38	34	30	84	
+ 85	+ 65	+ 64	+ 62	+ 60	+ 58	+ 56	+ 53	+ 51	+ 48	+ 46	+ 43	+ 40	+ 36	+ 32	+ 85	
86	67	65	63	61	59	57	55	52	50	47	45	42	38	35	86	
87	68	66	64	62	60	58	56	54	52	49	46	44	40	37	87	
88	69	67	65	64	62	60	58	55	53	51	48	45	42	39	88	
89	70	68	67	65	63	61	59	57	55	52	50	47	44	41	89	
+ 90	+ 71	+ 70	+ 68	+ 66	+ 64	+ 62	+ 60	+ 58	+ 56	+ 54	+ 52	+ 49	+ 46	+ 43	+ 90	
91	72	71	69	67	66	64	62	60	58	55	53	51	48	45	91	
92	74	72	70	69	67	65	63	61	59	57	55	52	50	47	92	
93	75	73	72	70	68	66	64	62	60	58	56	54	51	49	93	
94	76	74	73	71	69	68	66	64	62	60	58	55	53	50	94	
+ 95	+ 77	+ 76	+ 74	+ 72	+ 71	+ 69	+ 67	+ 65	+ 63	+ 61	+ 59	+ 57	+ 55	+ 52	+ 95	
96	78	77	75	74	72	70	68	66	65	63	61	58	56	54	96	
97	79	78	76	75	73	71	70	68	66	64	62	60	58	55	97	
98	80	79	78	76	74	73	71	69	67	65	64	61	59	57	98	
99	82	80	79	77	76	74	72	70	69	67	65	63	61	58	99	
+100	+ 83	+ 81	+ 80	+ 78	+ 77	+ 75	+ 73	+ 72	+ 70	+ 68	+ 66	+ 64	+ 62	+ 60	+100	
101	84	82	81	79	78	76	75	73	71	69	68	66	64	62	101	
102	85	84	82	81	79	78	76	74	72	71	69	67	65	63	102	
103	86	85	83	82	80	79	77	75	74	72	70	68	66	64	103	
104	87	86	84	83	81	80	78	77	75	73	72	70	68	66	104	
+105	+ 88	+ 87	+ 86	+ 84	+ 82	+ 81	+ 80	+ 78	+ 76	+ 75	+ 73	+ 71	+ 69	+ 67	+105	
106	89	88	87	85	84	82	81	79	78	76	74	72	71	69	106	
107	90	89	88	86	85	83	82	80	79	77	75	74	72	70	107	
108	92	90	89	87	86	84	83	82	80	78	77	75	73	71	108	
109	93	91	90	89	87	86	84	83	81	80	78	76	74	73	109	
+110	+ 94	+ 92	+ 91	+ 90	+ 88	+ 87	+ 85	+ 84	+ 82	+ 81	+ 79	+ 78	+ 76	+ 74	+110	
111	95	94	92	91	89	88	86	85	84	82	81	79	77	75	111	
112	96	95	93	92	90	89	88	86	85	83	82	80	78	77	112	
113	97	96	94	93	92	90	89	87	86	84	83	81	80	78	113	
114	98	97	96	94	93	91	90	88	87	86	84	82	81	79	114	
+115	+ 99	+ 98	+ 97	+ 95	+ 94	+ 92	+ 91	+ 90	+ 88	+ 87	+ 85	+ 84	+ 82	+ 80	+115	
116	100	99	98	96	95	94	92	91	89	88	86	85	83	82	116	
117	101	100	99	97	96	95	93	92	90	89	88	86	85	83	117	
118		101	100	98	97	96	94	93	92	90	89	87	86	84	118	
119			101	100	98	97	96	94	93	91	90	88	87	86	119	
+120				+101	+ 99	+ 98	+ 97	+ 95	+ 94	+ 93	+ 91	+ 90	+ 88	+ 87	+120	
121					100	99	98	96	95	94	92	91	89	88	121	
122						100	99	98	96	95	94	92	91	89	122	
123							100	99	97	96	95	93	92	90	123	
124								100	98	97	96	94	93	92	124	
+125									+100	+ 98	+ 97	+ 96	+ 94	+ 93	+125	
126										99	98	97	95	94	126	
127											99	98	96	95	127	
128												99	98	96	128	
129													99	97	129	
+130														+ 98	+130	
	13	14	15	16	17	18	19	20	21	22	23	24	25	26		

TABLE II.

DEW POINT.

Barometric pressure, 27.0 inches.

Air temp.	Depression of the wet-bulb thermometer (t-t').														Air temp.
t	26	27	28	29	30	31	32	33	34	35	36	37	38	39	t
+80	+19	+11	+1	-16											+80
81	22	15	7	-5											81
82	25	19	12	+2	-15										82
83	28	22	16	8	-4	-30									83
84	30	25	20	18	+3	-13									84
+85	+32	+28	+23	+17	+9	-2	-26								+85
86	35	30	26	21	14	+5	-10								86
87	37	33	29	24	18	10	-1	-23							87
88	39	35	31	27	22	15	+6	-8							88
89	41	38	34	30	25	19	12	+1	-19						89
+90	+43	+40	+36	+32	+28	+23	+16	+8	-6						+90
91	45	42	39	35	30	26	20	13	+3	-15					91
92	47	44	41	37	33	29	24	18	10	-3	-32				92
93	49	46	43	39	36	31	27	21	15	+5	-11				93
94	50	48	45	42	38	34	30	25	19	11	0	-24			94
+95	+52	+50	+47	+44	+40	+37	+32	+28	+22	+16	+7	-8			+95
96	54	51	49	46	42	39	35	31	26	20	13	+2	-18		96
97	55	53	50	48	45	41	38	34	29	24	18	9	-4		97
98	57	55	52	50	47	44	40	36	32	27	22	15	+4	-13	98
99	58	56	54	51	48	46	42	39	35	30	25	19	11	-1	99
+100	+60	+58	+56	+53	+50	+48	+44	+41	+37	+33	+28	+23	+16	+7	+100
101	62	60	57	55	52	50	46	43	40	36	32	26	21	13	101
102	63	61	59	56	54	51	48	45	42	38	34	30	24	18	102
103	64	63	60	58	56	53	50	48	44	41	37	33	28	22	103
104	66	64	62	60	57	55	52	50	46	43	40	36	31	26	104
105	+67	+66	+63	+61	+59	+57	+54	+52	+49	+46	+42	+38	+34	+29	+105
106	69	67	65	63	61	58	56	53	51	48	44	41	37	33	106
107	70	68	66	64	62	60	58	55	52	50	47	43	40	36	107
108	71	70	68	66	64	62	59	57	54	52	49	46	42	38	108
109	73	71	69	67	65	63	61	59	56	54	51	48	44	41	109
+110	+74	+72	+71	+69	+67	+65	+63	+60	+58	+55	+53	+50	+47	+43	+110
111	75	74	72	70	68	66	64	62	60	57	55	52	49	46	111
112	77	75	73	72	70	68	66	64	61	59	56	54	51	48	112
113	78	76	75	73	71	69	67	65	63	61	58	56	53	50	113
114	79	78	76	74	72	71	69	67	64	62	60	58	55	52	114
+115	+80	+79	+77	+76	+74	+72	+70	+68	+66	+64	+62	+59	+57	+54	+115
116	82	80	79	77	75	74	72	70	68	66	63	61	59	56	116
117	83	82	80	78	77	75	73	71	69	67	65	63	60	58	117
118	84	83	81	80	78	76	74	73	71	69	67	64	62	60	118
119	86	84	83	81	79	78	76	74	72	70	68	66	64	62	119
+120	+87	+85	+84	+82	+81	+79	+77	+75	+74	+72	+70	+68	+66	+63	+120
121	88	87	85	84	82	80	79	77	75	73	71	69	67	65	121
122	89	88	86	85	83	82	80	78	76	74	73	71	69	67	122
123	90	89	88	86	84	83	81	80	78	76	74	72	70	68	123
124	92	90	89	87	86	84	82	81	79	77	76	74	72	70	124
+125	+93	+92	+90	+88	+87	+85	+84	+82	+80	+79	+77	+75	+73	+71	+125
126	94	93	91	90	88	87	85	84	82	80	78	77	75	73	126
127	95	94	92	91	89	88	86	85	83	82	80	78	76	74	127
128	96	95	94	92	91	89	88	86	84	83	81	79	78	76	128
129	97	96	95	93	92	90	89	87	86	84	82	81	79	77	129
130	+98	+97	+96	+94	+93	+92	+90	+89	+87	+85	+84	+82	+80	+79	+130
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	.

TABLE III.

DEW POINT.

Barometric pressure; 24.0 inches.

Air temp.	Depression of the wet-bulb thermometer ($t-t'$).													Air temp.	
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
-20	-20														-20
19	19														19
18	18	-31													18
17	17	29													17
-16	-16	-28													-16
-15	-15	-26													-15
14	14	25													14
13	13	24													13
12	12	22													12
-11	-11	-21													-11
-10	-10	-20													-10
9	9	18													9
8	8	16	-29												8
7	7	15	27												7
-6	-6	-14	-26												-6
-5	-5	-13	-23												-5
4	4	11	21												4
3	3	10	19												3
2	2	9	17												2
-1	-1	-7	-16	-29											-1
0	0	-6	-14	-26											0
+1	+1	5	12	24											+1
2	2	4	11	21											2
3	3	2	9	19											3
4	4	-1	-8	-17	-31										4
+5	+5	0	-6	-15	-28										+5
6	6	+1	5	13	25										6
7	7	2	3	11	22										7
8	8	3	2	9	19										8
9	9	5	-1	-7	-16										9
+10	+10	+6	+1	-6	-14	-27									+10
11	11	7	2	4	12	24									11
12	12	8	4	3	10	20									12
13	13	9	5	-1	8	17									13
14	14	10	6	0	-6	-15	-29								14
+15	+15	+12	+7	+2	-4	-12	-25								+15
16	16	13	8	4	-2	10	21								16
17	17	14	10	5	0	7	17								17
18	18	15	11	7	+3	-5	-14								18
19	19	16	12	8	3	-3	-12	-31	24						19
+20	+20	+17	+14	+10	+5	-1	-9	-20							+20
21	21	18	15	11	7	+1	6	16							21
22	22	19	16	12	8	3	3	13	-26						22
23	23	20	17	14	10	5	-1	10	21						23
24	24	21	18	15	11	6	+1	-6	-17						24
+25	+25	+22	+19	+16	+13	+8	+3	-4	-13	-28					+25
26	26	23	21	18	14	10	5	-1	9	22					26
27	27	24	22	19	16	12	7	+1	6	17					27
28	28	26	23	20	17	13	9	3	3	13	-29				28
29	29	27	24	21	18	15	10	5	-1	-10	-22				29
+30	+30	+28	+25	+22	+19	+16	+12	+7	+2	-6	-17				+30
0	1	2	3	4	5	6	7	8	9	10	11	12	13		

TABLE III.

DEW POINT.

Barometric pressure, 24.0 inches.

Air temp.	Depression of the wet-bulb thermometer (t-t').													Air temp.	
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
+30	+30	+28	+25	+22	+19	+16	+12	+7	+2	-6	-17				+30
31	31	29	26	24	21	17	14	9	4	-3	12	-29			31
32	32	30	27	25	22	19	15	11	6	0	8	22			32
33	33	31	28	26	23	20	17	13	8	+2	5	16			33
34	34	32	29	27	24	22	18	15	10	5	-2	-11	-27		34
+35	+35	+33	+30	+27	+24	+23	+20	+16	+12	+7	+1	-7	-20		+35
36	36	34	31	28	26	24	21	18	14	9	4	-4	14		36
37	37	35	32	30	27	24	22	19	16	11	6	0	10	-25	37
38	38	36	33	31	28	25	22	20	17	13	8	+2	6	18	38
39	39	37	34	32	29	26	23	20	19	15	10	5	-2	-12	39
+40	+40	+38	+36	+33	+30	+28	+25	+21	+18	17	+13	+8	+1	-8	+40
41	41	39	37	34	32	29	26	23	19	15	10	4	-4	14	41
42	42	40	38	35	33	30	27	24	20	17	12	10	7	0	42
43	43	41	39	36	34	31	29	26	22	19	14	9	5	+3	43
44	44	42	40	38	35	33	30	27	24	20	16	11	6	1	44
+45	+45	+43	+41	+39	+36	+34	+31	+28	+25	+22	+18	+14	+8	0	+45
46	46	44	42	40	38	35	32	30	27	23	20	16	10	+4	46
47	47	45	43	41	39	36	34	31	28	25	21	18	13	7	47
48	48	46	44	42	40	38	35	32	29	26	23	19	15	9	48
49	49	47	45	43	41	39	36	34	31	28	25	21	17	12	49
+50	+50	+48	+46	+44	+42	+40	+37	+35	+32	+29	+26	+23	+19	+14	+50
51	51	49	47	45	43	41	39	36	34	31	28	24	21	16	51
52	52	50	48	46	44	42	40	38	35	32	29	26	23	18	52
53	53	51	49	48	46	43	41	39	36	34	31	28	24	20	53
54	54	52	50	49	47	45	42	40	38	35	32	29	26	22	54
+55	+55	+53	+52	+50	+48	+46	+44	+41	+39	+36	+34	+31	+28	+24	+55
56	56	54	53	51	49	47	45	42	40	38	35	32	29	26	56
57	57	55	54	52	50	48	46	44	42	39	36	34	31	28	57
58	58	56	55	53	51	49	47	45	43	40	38	35	32	29	58
59	59	57	56	54	52	50	48	46	44	42	39	37	34	31	59
+60	+60	+58	+57	+55	+53	+51	+49	+47	+45	+43	+41	+38	+35	+32	+60
61	61	59	58	56	54	52	51	49	46	44	42	40	37	34	61
62	62	60	59	57	55	54	52	50	48	46	43	41	39	36	62
63	63	61	60	58	56	55	53	51	49	47	45	42	40	37	63
64	64	62	61	59	58	56	54	52	50	48	46	44	41	38	64
+65	+65	+64	+62	+60	+59	+57	+55	+53	+51	+49	+47	+45	+43	+40	+65
66	66	65	63	61	60	58	56	54	52	51	48	46	44	42	66
67	67	66	64	62	61	59	57	56	54	52	50	48	45	43	67
68	68	67	65	63	62	60	58	57	55	53	51	49	47	44	68
69	69	68	66	64	63	61	60	58	56	54	52	50	48	46	69
+70	+70	+69	+67	+66	+64	+62	+61	+59	+57	+55	+54	+52	+49	+47	+70
71	71	70	68	67	65	63	62	60	58	57	55	53	51	49	71
72	72	71	69	68	66	64	63	61	60	58	56	54	52	50	72
73	73	72	70	69	67	66	64	62	61	59	57	55	53	51	73
74	74	73	71	70	68	67	65	64	62	60	58	56	54	52	74
+75	+75	+74	+72	+71	+69	+68	+66	+65	+63	+61	+59	+58	+56	+54	+75
76	76	75	73	72	70	69	67	66	64	62	61	59	57	55	76
77	77	76	74	73	71	70	68	67	65	64	62	60	58	56	77
78	78	77	75	74	72	71	69	68	66	65	63	61	59	58	78
79	79	78	76	75	73	72	70	69	67	66	64	62	61	59	79
+80	+80	+79	+77	+76	+74	+73	+72	+70	+68	+67	+65	+64	+62	+60	+80
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE III.

Air temp.						Air temp.
t	13	14	15	16	17	t
+30						+30
31						31
32						32
33						33
34						34
+35						+35
36						36
37	-25					37
38	18					38
39	-12	-31				39
+40						+40
41	-8	-22				41
42	-4	15				42
43	0	10	-25			43
44	+3	6	18			44
	0	-2	-12	-29		
+45						+45
46	0	+2	-7	-20		46
47	+4	-6	2	13		47
48	7	-1	13	9	-21	48
49	9	+2	8	24	-14	49
	12	5	-3	16		
+50						+50
51	+14	+8	+1	-9	-2	51
52	16	11	4	-4	1	52
53	18	14	8	0	1	53
54	20	16	10	+4		54
	22	18	13	7	-	
+55						+55
56	+24	+20	+16	+10	+1	56
57	26	22	18	13	-7	57
58	28	24	20	16	+4	58
59	29	26	22	18	+12	59
	31	27	24	20	+13	
+60						+60
61	+32	+29	+26	+22	+11	61
62	34	31	28	24	2	62
63	36	32	29	26	2	63
64	37	34	31	28	2	64
	38	36	33	30	2	
+65						+65
66	+40	+37	+34	+31	+2	66
67	42	39	36	33	3	67
68	43	40	38	35	3	68
69	44	42	39	37	3	69
	46	43	41	38	3	
+70						+70
71	+47	+45	+42	+40	+3	71
72	49	46	44	41	3	72
73	50	48	45	43	4	73
74	51	49	47	44	4	74
	52	50	48	46	4	
+75						+75
76	+54	+52	+50	+47	+4	76
77	55	53	51	49	4	77
78	56	54	52	50	4	78
79	58	56	54	52	4	79
	59	57	55	53	5	
+80						+80
	+60	+58	+56	+54	+5	
	13	14	15	16	17	

TABLE III.

DEW POINT.

Barometric pressure, 24.0 inches.

Air temp.	Depression of the wet-bulb thermometer (t-t').														Air temp.
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
+ 80	+ 80	+ 79	+ 77	+ 76	+ 74	+ 73	+ 72	+ 70	+ 68	+ 67	+ 65	+ 64	+ 62	+ 60	+ 80
81	81	80	78	77	76	74	73	71	70	68	66	65	63	61	81
82	82	81	79	78	77	75	74	72	71	69	68	66	64	62	82
83	83	82	80	79	78	76	75	73	72	70	69	67	65	64	83
84	84	83	81	80	79	77	76	74	73	71	70	68	67	65	84
+ 85	+ 85	+ 84	+ 82	+ 81	+ 80	+ 78	+ 77	+ 75	+ 74	+ 72	+ 71	+ 69	+ 68	+ 66	+ 85
86	86	85	83	82	81	79	78	77	75	74	72	70	69	67	86
87	87	86	84	83	82	80	79	78	76	75	73	72	70	68	87
88	88	87	85	84	83	81	80	79	77	76	74	73	71	70	88
89	89	88	86	85	84	82	81	80	78	77	75	74	72	71	89
+ 90	+ 90	+ 89	+ 87	+ 86	+ 85	+ 84	+ 82	+ 81	+ 79	+ 78	+ 76	+ 75	+ 74	+ 72	+ 90
91	91	90	88	87	86	85	83	82	80	79	78	76	75	73	91
92	92	91	89	88	87	86	84	83	82	80	79	77	76	74	92
93	93	92	90	89	88	87	85	84	83	81	80	78	77	75	93
94	94	93	91	90	89	88	86	85	84	82	81	80	78	76	94
+ 95	+ 95	+ 94	+ 92	+ 91	+ 90	+ 89	+ 87	+ 86	+ 85	+ 83	+ 82	+ 81	+ 79	+ 78	+ 95
96	96	95	94	92	91	90	88	87	86	84	83	82	80	79	96
97	97	96	95	93	92	91	89	88	87	86	84	83	81	80	97
98	98	97	96	94	93	92	90	89	88	87	85	84	82	81	98
99	99	98	97	95	94	93	92	90	89	88	86	85	84	82	99
+100	+100	+ 99	+ 98	+ 96	+ 95	+ 94	+ 93	+ 91	+ 90	+ 89	+ 87	+ 86	+ 85	+ 83	+100
101	101	100	99	97	96	95	94	92	91	90	88	87	86	84	101
102	102	101	100	98	97	96	95	93	92	91	90	88	87	85	102
103	103	102	101	99	98	97	96	94	93	92	91	89	88	86	103
104	104	103	102	100	99	98	97	96	94	93	92	90	89	88	104
+105	+105	+104	+103	+101	+100	+ 99	+ 98	+ 97	+ 95	+ 94	+ 93	+ 91	+ 90	+ 89	+105
106	106			102	101	100	99	98	96	95	94	92	91	90	106
107	107			104	102	101	100	99	97	96	95	94	92	91	107
108	108				103		102	101	100	98	97	96	95	93	108
109	109						102	101	100	99	98	97	96	94	109
+110	+110						+103	+102	+100	+ 99	+ 98	+ 97	+ 95	+ 94	+110
111	111							103	102	100	99	98	96	95	111
112	112								103	100	100	99	98	96	112
113	113									101	101	100	99	97	113
114	114									102	102	101	100	98	114
+115	+115											+102	+101	+100	+115
116	116												102	101	116
117	117													102	117
118	118														118
119	119														119
+120	+120														+120
121	121														121
122	122														122
123	123														123
124	124														124
+125	+125														+125
126	126														126
127	127														127
128	128														128
129	129														129
+130	+130														+130
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE III.

DEW-POINT.

Barometric pressure, 24.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
+ 70	-24														+ 70
71	-13														71
72	-5														72
73	+ 2	-19													73
74	6	-8													74
+ 75	+11	-1	-18												+ 75
76	15	+5	-7												76
77	18	10	0	-16											77
78	20	14	+6	-6	-30										78
79	23	17	10	+1	-14										79
+ 80	+26	+20	+15	+7	-5	-27									+ 80
81	28	23	18	11	+2	-12									81
82	30	26	21	16	8	-3	-24								82
83	33	28	24	19	13	+4	-10								83
84	35	31	27	22	16	9	-2	-21							84
+ 85	+37	+33	+29	+25	+20	+14	+5	-8							+ 85
86	39	35	32	28	23	18	10	0	-17						86
87	41	37	34	30	26	21	15	+7	-6						87
88	43	39	36	32	28	24	19	12	+2	-14					88
89	44	41	38	35	31	27	22	16	8	-3	-26				89
+ 90	+46	+43	+40	+37	+34	+30	+25	+20	+13	+4	-10				+ 90
91	48	45	42	39	36	32	28	23	17	10	-1	-21			91
92	50	47	44	41	38	34	30	26	21	15	+6	-7			92
93	51	49	46	43	40	37	33	29	24	19	12	+2	-16		93
94	53	50	48	45	42	39	36	32	27	22	16	8	-4	-30	94
+ 95	+54	+52	+50	+47	+44	+41	+38	+34	+30	+26	+20	+14	+4	-11	+ 95
96	56	54	51	49	46	43	40	37	33	28	24	18	10	-1	96
97	58	55	53	51	48	45	42	39	35	31	27	22	15	+7	97
98	59	57	55	52	50	47	44	41	38	34	30	25	19	12	98
99	60	58	56	54	52	49	46	43	40	36	32	28	23	17	99
+100	+62	+60	+58	+56	+53	+51	+48	+45	+42	+39	+35	+31	+26	+21	+100
101	63	62	59	57	55	52	50	47	44	41	38	34	29	24	101
102	65	63	61	59	57	54	52	49	46	43	40	36	32	28	102
103	66	64	62	60	58	56	54	51	48	45	42	39	35	31	103
104	68	66	64	62	60	58	55	53	50	47	44	41	38	34	104
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	

TABLE III.

DEW POINT.

Barometric pressure, 23.0 inches.

Air temp. °	Depression of the wet-bulb thermometer (t-t').														Air temp. °
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
+ 70	-15														+ 70
71	- 7														71
72	0	-18													72
73	+ 6	- 8													73
74	+10	- 1	-17												74
+ 75	+13	+ 5	- 7	-31											+ 75
76	17	9	0	-15											76
77	19	13	+ 6	- 6	-28										77
78	22	17	10	+ 1	-14										78
79	24	20	14	+ 7	- 4	-25									79
+ 80		+23	+18	+11	+ 2	-12									+ 80
81		25	21	15	8	- 3	-22								81
82		28	24	18	12	+ 4	-10								82
83		30	26	22	16	9	- 1	-19							83
84		32	29	24	19	13	+ 5	- 7							84
+ 85			+31	+27	+22	+17	+10	0	-16						+ 85
86			33	30	25	20	15	+ 7	- 5	-29					86
87				32	28	23	19	12	+ 3	-13					87
88				34	30	26	22	16	8	- 3	-24				88
89				36	33	29	25	20	18	+ 4	- 9				89
+ 90					+35	+31	+27	+23	+17	+10	0	-19			+ 90
91						34	30	26	21	15	+ 6	- 6			91
92							32	28	24	19	12	+ 2	-14		92
93							35	31	27	22	16	8	- 3	-26	93
94							37	34	30	25	20	14	+ 4	-10	94
+ 95								+36	+32	+28	+23	+18	+10	0	+ 95
96									35	31	26	21	15	+ 7	96
97										33	29	25	19	12	97
98											32	28	23	17	98
99												30	26	21	99
+100													+ 29	+24	+100
101														27	101
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	

TABLE III.

DEW POINT.

Barometric pressure, 24.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t—t').															Air temp. t
	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
+ 80	+ 60	+ 58	+ 56	+ 54	+ 52	+ 50	+ 48	+ 45	+ 43	+ 40	+ 37	+ 33	+ 30	+ 26	+ 80	
81	61	59	58	56	54	52	49	47	44	42	39	36	32	28	81	
82	62	61	59	57	55	53	51	48	46	43	40	37	34	30	82	
83	64	62	60	58	56	54	52	50	48	45	42	39	36	33	83	
84	65	63	61	60	58	56	54	51	49	47	44	41	38	35	84	
+ 85	+ 66	+ 64	+ 63	+ 61	+ 59	+ 57	+ 55	+ 53	+ 51	+ 48	+ 46	+ 43	+ 40	+ 37	+ 85	
86	67	66	64	62	60	58	56	54	52	50	47	45	42	39	86	
87	68	67	65	63	62	60	58	56	54	51	49	46	44	41	87	
88	70	68	66	65	63	61	59	57	55	53	50	48	46	43	88	
89	71	69	68	66	64	62	60	58	56	54	52	50	47	44	89	
+ 90	+ 72	+ 70	+ 69	+ 67	+ 65	+ 64	+ 62	+ 60	+ 58	+ 56	+ 54	+ 51	+ 49	+ 46	+ 90	
91	73	72	70	68	67	65	63	61	59	57	55	53	51	48	91	
92	74	73	71	70	68	66	64	62	61	59	56	54	52	50	92	
93	75	74	72	71	69	67	66	64	62	60	58	56	54	51	93	
94	76	75	74	72	70	69	67	65	63	61	59	57	55	53	94	
+ 95	+ 78	+ 76	+ 75	+ 73	+ 72	+ 70	+ 68	+ 66	+ 65	+ 63	+ 61	+ 59	+ 57	+ 54	+ 95	
96	79	77	76	74	73	71	69	68	66	64	62	60	58	56	96	
97	80	78	77	75	74	72	71	69	67	65	64	62	60	58	97	
98	81	80	78	77	75	74	72	70	68	67	65	63	61	59	98	
99	82	81	79	78	76	75	73	72	70	68	66	64	62	60	99	
+ 100	+ 83	+ 82	+ 80	+ 79	+ 77	+ 76	+ 74	+ 73	+ 71	+ 69	+ 68	+ 66	+ 64	+ 62	+ 100	
101	84	83	82	80	79	77	76	74	72	71	69	67	65	63	101	
102	85	84	83	81	80	78	77	75	74	72	70	68	67	65	102	
103	86	85	84	82	81	79	78	76	75	73	71	70	68	66	103	
104	88	86	85	84	82	81	79	78	76	74	73	71	69	68	104	
+ 105	+ 89	+ 87	+ 86	+ 85	+ 83	+ 82	+ 80	+ 79	+ 77	+ 76	+ 74	+ 72	+ 71	+ 69	+ 105	
106	90	88	87	86	84	83	81	80	78	77	75	74	72	70	106	
107	91	90	88	87	85	84	83	81	80	78	76	75	73	72	107	
108	92	91	89	88	86	85	84	82	81	79	78	76	74	73	108	
109	93	92	90	89	88	86	85	83	82	80	79	77	76	74	109	
+ 110	+ 94	+ 93	+ 92	+ 90	+ 89	+ 87	+ 86	+ 85	+ 83	+ 82	+ 80	+ 78	+ 77	+ 75	+ 110	
111	95	94	93	91	90	89	87	86	84	83	81	80	78	77	111	
112	96	95	94	92	91	90	88	87	85	84	82	81	79	78	112	
113	97	96	95	93	92	91	89	88	87	85	84	82	81	79	113	
114	98	97	96	94	93	92	90	89	88	86	85	83	82	80	114	
+ 115	+ 100	+ 98	+ 97	+ 96	+ 94	+ 93	+ 92	+ 90	+ 89	+ 88	+ 86	+ 85	+ 83	+ 82	+ 115	
116	101	99	98	97	95	94	93	91	90	89	87	86	84	83	116	
117	102	100	99	98	96	95	94	93	91	90	88	87	85	84	117	
118		101	100	99	98	96	95	94	92	91	90	88	87	85	118	
119			101	100	99	97	96	95	93	92	91	89	88	86	119	
+ 120				+ 101	+ 100	+ 98	+ 97	+ 96	+ 94	+ 93	+ 92	+ 90	+ 89	+ 88	+ 120	
121					101	100	98	97	96	94	93	92	90	89	121	
122						101	99	98	97	95	94	93	91	90	122	
123							100	99	98	97	95	94	92	91	123	
124								100	99	98	96	95	94	92	124	
+ 125									+ 100	+ 99	+ 98	+ 96	+ 95	+ 93	+ 125	
126										100	99	97	96	94	126	
127											100	98	97	96	127	
128												100	98	97	128	
129													99	98	129	
+ 130														+ 99	+ 130	
	13	14	15	16	17	18	19	20	21	22	23	24	25	26		

TABLE IV.

DEW POINT.

Barometric pressure, 21.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	
-20	-20														-20
19	19	-31													19
18	18	29													18
17	17	27													17
-16	-16	-26													-16
-15	-15	-24													-15
14	14	23													14
13	13	22													13
12	12	20													12
-11	-11	-19	-30												-11
-10	-10	-18	-28												-10
9	9	16	26												9
8	8	15	24												8
7	7	14	23												7
-6	-6	-12	-22												-6
-5	-5	-11	-19												-5
4	4	10	18	-30											4
3	3	9	16	27											3
2	2	8	14	25											2
-1	-1	-6	-13	-23											-1
0	0	-5	-12	-21											0
+1	+1	4	10	19											+1
2	2	3	8	17	-29										2
3	3	2	7	15	26										3
4	4	-1	-6	-13	-23										4
+5	+5	+1	-4	-11	-21										+5
6	6	2	3	10	18										6
7	7	3	2	8	16	-28									7
8	8	4	-1	6	14	24									8
9	9	5	+1	-5	-12	-22									9
+10	+10	+6	+2	-3	-10	-19									+10
11	11	8	4	-2	8	16	-29								11
12	12	9	5	0	6	14	24								12
13	13	10	6	+1	5	11	21								13
14	14	11	7	2	-3	-9	-18								14
+15	+15	+12	+8	+4	-1	-7	-15	-29							+15
16	16	13	10	5	0	6	13	24							16
17	17	14	11	7	+2	3	10	20							17
18	18	15	12	8	4	-1	8	17							18
19	19	16	13	10	5	0	-6	-14	-27						19
+20	+20	+17	+15	+11	+7	+2	-3	-11	-22						+20
21	21	18	16	12	8	4	-1	8	18						21
22	22	19	17	14	10	6	+1	6	15	-28					22
23	23	21	18	15	11	8	3	4	11	23					23
24	24	22	19	16	13	9	4	-1	-9	-18					24
+25	+25	+23	+20	+17	+14	+10	+6	+1	-6	-14	-28				+25
26	26	24	21	18	15	12	8	3	3	11	22				26
27	27	25	22	20	17	14	10	5	-1	8	17				27
28	28	26	23	21	18	15	11	7	+2	5	13	-27			28
29	29	27	24	22	19	16	13	9	4	-2	-10	-21			29
+30	+30	+28	+26	+23	+20	+18	+14	+10	+6	0	-6	-16			+30
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

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TABLE IV.

DEW POINT.

Barometric pressure, 21.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	
+30	+30	+28	+26	+23	+20	+18	+14	+10	+6	0	-6	-18			+30
31	31	29	27	24	22	19	16	12	8	+3	-4	12	-25		31
32	32	30	28	25	23	20	17	14	10	5	-1	8	19		32
33	33	31	29	26	24	21	19	15	11	7	+2	5	14	-30	33
34	34	32	29	28	25	23	20	17	13	9	4	-2	-10	-22	34
+35	+35	+33	+30	+28	+26	+24	+21	+18	+15	+11	+6	+1	-6	-17	+35
36	36	34	32	29	26	25	23	20	16	13	8	4	-3	12	36
37	37	35	33	30	28	25	24	21	18	15	10	6	0	8	37
38	38	36	34	31	29	26	24	22	19	16	12	8	+3	4	38
39	39	37	35	32	30	28	25	22	21	18	14	10	5	-1	39
+40	+40	+38	+36	+34	+31	+29	+26	+23	+20	+19	+16	+12	+8	+2	+40
41	41	39	37	35	32	30	27	24	21	18	15	12	10	5	41
42	42	40	38	36	34	31	28	26	23	19	16	13	12	7	42
43	43	41	39	37	35	32	30	27	24	21	17	14	14	10	43
44	44	42	40	38	36	34	31	28	26	23	19	15	11	12	44
+45	+45	+43	+41	+39	+37	+35	+32	+30	+27	+24	+21	+17	+13	+8	+45
46	46	44	42	40	38	36	34	31	28	25	22	19	15	10	46
47	47	45	43	41	39	37	35	32	30	27	24	21	17	12	47
48	48	46	44	42	40	38	36	34	31	28	25	22	19	14	48
49	49	47	45	44	42	39	37	35	32	30	27	24	20	16	49
+50	+50	+48	+46	+45	+43	+41	+38	+36	+34	+31	+28	+25	+22	+18	+50
51	51	49	48	46	44	42	40	37	35	32	30	27	24	20	51
52	52	50	49	47	45	43	41	38	36	34	31	28	25	22	52
53	53	51	50	48	46	44	42	40	37	35	32	30	27	24	53
54	54	52	51	49	47	45	43	41	39	36	34	31	28	25	54
+55	+55	+53	+52	+50	+48	+46	+44	+42	+40	+38	+35	+33	+30	+27	+55
56	56	54	53	51	49	47	46	43	41	39	37	34	31	28	56
57	57	55	54	52	50	48	47	45	42	40	38	36	33	30	57
58	58	56	55	53	51	50	48	46	44	42	39	37	34	32	58
59	59	57	56	54	52	51	49	47	45	43	41	38	36	33	59
+60	+60	+58	+57	+55	+54	+52	+50	+48	+46	+44	+42	+40	+37	+35	+60
61	61	60	58	56	55	53	51	49	47	45	43	41	39	36	61
62	62	61	59	57	56	54	52	50	48	47	44	42	40	38	62
63	63	62	60	58	57	55	53	52	50	48	46	44	42	39	63
64	64	63	61	60	58	56	54	53	51	49	47	45	43	40	64
+65	+65	+64	+62	+61	+59	+57	+56	+54	+52	+50	+48	+46	+44	+42	+65
66	66	65	63	62	60	58	57	55	53	51	50	48	46	43	66
67	67	66	64	63	61	60	58	56	54	53	51	49	47	45	67
68	68	67	65	64	62	61	59	57	56	54	52	50	48	46	68
69	69	68	66	65	63	62	60	58	57	55	53	51	49	47	69
+70	+70	+69	+67	+66	+64	+63	+61	+60	+58	+56	+54	+52	+51	+49	+70
71	71	70	68	67	65	64	62	61	59	57	56	54	52	50	71
72	72	71	69	68	66	65	63	62	60	58	57	55	53	51	72
73	73	72	70	69	67	66	64	63	61	60	58	56	54	52	73
74	74	73	71	70	68	67	65	64	62	61	59	57	56	54	74
+75	+75	+74	+72	+71	+69	+68	+66	+65	+63	+62	+60	+58	+57	+55	+75
76	76	75	73	72	70	69	68	66	64	63	61	60	58	56	76
77	77	76	74	73	72	70	69	67	66	64	62	61	59	57	77
78	78	77	75	74	73	71	70	68	67	65	64	62	60	59	78
79	79	78	76	75	74	72	71	69	68	66	65	63	62	60	79
+80	+80	+79	+77	+76	+75	+73	+72	+70	+69	+67	+66	+64	+63	+61	+80
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE IV.

DEW POINT.

Barometric pressure, 21.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
+30															+30
31															31
32															32
33	-30														33
34	-22														34
+35	-17														+35
36	-12	-26													36
37	-8	-19													37
38	-4	-14	-29												38
39	-1	-9	-21												39
+40	+2	-5	-15												+40
41	5	-2	-10	-23											41
42	7	+1	-6	-16											42
43	10	4	-2	-11	-25										43
44	12	7	+1	-6	-18										44
+45	+8	+9	+4	-3	-12	-27									+45
46	10	4	7	+1	-7	-19									46
47	12	7	0	+4	-3	-12	-30								47
48	14	10	3	-4	+1	-8	-21								48
49	16	12	6	-1	-10	3	-14								49
+50	+18	+14	+9	+3	-6	-19	-8	-22							+50
51	20	16	12	6	-1	-12	-15								51
52	22	18	14	9	+2	-7	-22								52
53	24	20	16	11	6	-2	-14								53
54	25	22	18	14	9	+2	-8	-24							54
+55	+27	+24	+20	+16	+12	+5	-3	-16							+55
56	28	25	22	18	14	9	+1	9	-27						56
57	30	27	24	20	16	11	5	-4	-17						57
58	32	29	26	22	18	14	8	+1	-10	-28					58
59	33	30	27	24	20	16	11	5	-4	-18					59
+60	+35	+32	+29	+26	+22	+19	+14	+8	+1	-10	-30				+60
61	36	33	31	28	24	21	16	11	5	-4	-18				61
62	38	35	32	29	26	23	19	14	8	+1	-10	-31			62
63	39	36	34	31	28	25	21	16	11	5	-4	-18			63
64	40	38	36	33	30	26	23	19	14	9	+1	-10	-31		64
+65	+42	+39	+37	+34	+31	+28	+25	+21	+17	+12	+5	-4	-18		+65
66	43	41	38	36	33	30	27	23	19	15	9	+1	-10	-31	66
67	45	42	40	38	35	32	29	25	22	17	12	6	-4	-18	67
68	46	44	41	39	36	34	30	27	24	20	15	9	+2	-10	68
69	47	45	43	41	38	35	33	29	26	22	18	13	6	-3	69
+70	+49	+46	+44	+42	+40	+37	+34	+31	+28	+24	+20	+16	+10	+2	+70
71	50	48	46	44	41	38	36	33	30	26	23	18	13	7	71
72	51	49	47	45	43	40	38	35	32	28	25	21	16	11	72
73	52	50	48	46	44	42	39	36	33	30	27	23	19	14	73
74	54	52	50	48	46	43	41	38	35	32	29	25	21	17	74
+75	+55	+53	+51	+49	+47	+45	+42	+40	+37	+34	+31	+28	+24	+20	+75
76	56	54	52	50	48	46	44	41	39	36	33	30	26	22	76
77	57	56	54	52	50	48	45	43	40	38	35	32	28	24	77
78	59	57	55	53	51	49	47	44	42	39	37	34	30	27	78
79	60	58	56	54	52	50	48	46	44	41	38	36	32	29	79
+80	+61	+59	+58	+56	+54	+52	+50	+47	+45	+43	+40	+37	+34	+31	+80
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															

TABLE IV.

DEW POINT.

Barometric pressure, 21.0 inches.

Air temp.	Depression of the wet-bulb thermometer (t-t').														Air temp.
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
+ 80	+ 80	+ 79	+ 77	+ 76	+ 75	+ 73	+ 72	+ 70	+ 69	+ 67	+ 66	+ 64	+ 63	+ 61	+ 80
+ 81	+ 81	+ 80	+ 78	+ 77	+ 76	+ 74	+ 73	+ 71	+ 70	+ 68	+ 67	+ 65	+ 64	+ 62	+ 81
+ 82	+ 82	+ 81	+ 79	+ 78	+ 77	+ 75	+ 74	+ 73	+ 71	+ 70	+ 68	+ 67	+ 65	+ 63	+ 82
+ 83	+ 83	+ 82	+ 80	+ 79	+ 78	+ 76	+ 75	+ 74	+ 72	+ 71	+ 69	+ 68	+ 66	+ 64	+ 83
+ 84	+ 84	+ 83	+ 82	+ 80	+ 79	+ 77	+ 76	+ 75	+ 73	+ 72	+ 70	+ 69	+ 67	+ 66	+ 84
+ 85	+ 85	+ 84	+ 83	+ 81	+ 80	+ 78	+ 77	+ 76	+ 74	+ 73	+ 72	+ 70	+ 68	+ 67	+ 85
+ 86	+ 86	+ 85	+ 84	+ 82	+ 81	+ 80	+ 78	+ 77	+ 75	+ 74	+ 73	+ 71	+ 70	+ 68	+ 86
+ 87	+ 87	+ 86	+ 85	+ 83	+ 82	+ 81	+ 79	+ 78	+ 76	+ 75	+ 74	+ 72	+ 71	+ 69	+ 87
+ 88	+ 88	+ 87	+ 86	+ 84	+ 83	+ 82	+ 80	+ 79	+ 78	+ 76	+ 75	+ 73	+ 72	+ 70	+ 88
+ 89	+ 89	+ 88	+ 87	+ 85	+ 84	+ 83	+ 81	+ 80	+ 79	+ 77	+ 76	+ 74	+ 73	+ 72	+ 89
+ 90	+ 90	+ 89	+ 88	+ 86	+ 85	+ 84	+ 82	+ 81	+ 80	+ 78	+ 77	+ 76	+ 74	+ 73	+ 90
+ 91	+ 91	+ 90	+ 89	+ 87	+ 86	+ 85	+ 83	+ 82	+ 81	+ 79	+ 78	+ 77	+ 75	+ 74	+ 91
+ 92	+ 92	+ 91	+ 90	+ 88	+ 87	+ 86	+ 84	+ 83	+ 82	+ 80	+ 79	+ 78	+ 76	+ 75	+ 92
+ 93	+ 93	+ 92	+ 91	+ 89	+ 88	+ 87	+ 86	+ 84	+ 83	+ 82	+ 80	+ 79	+ 77	+ 76	+ 93
+ 94	+ 94	+ 93	+ 92	+ 90	+ 89	+ 88	+ 87	+ 85	+ 84	+ 83	+ 81	+ 80	+ 78	+ 77	+ 94
+ 95	+ 95	+ 94	+ 93	+ 91	+ 90	+ 89	+ 88	+ 86	+ 85	+ 84	+ 82	+ 81	+ 80	+ 78	+ 95
+ 96	+ 96	+ 95	+ 94	+ 92	+ 91	+ 90	+ 89	+ 87	+ 86	+ 85	+ 83	+ 82	+ 81	+ 79	+ 96
+ 97	+ 97	+ 96	+ 95	+ 93	+ 92	+ 91	+ 90	+ 88	+ 87	+ 86	+ 84	+ 83	+ 82	+ 80	+ 97
+ 98	+ 98	+ 97	+ 96	+ 94	+ 93	+ 92	+ 91	+ 89	+ 88	+ 87	+ 86	+ 84	+ 83	+ 82	+ 98
+ 99	+ 99	+ 98	+ 97	+ 95	+ 94	+ 93	+ 92	+ 90	+ 89	+ 88	+ 87	+ 85	+ 84	+ 83	+ 99
+ 100	+ 100	+ 99	+ 98	+ 96	+ 95	+ 94	+ 93	+ 92	+ 90	+ 89	+ 88	+ 86	+ 85	+ 84	+ 100
+ 101	+ 101	+ 100	+ 99	+ 97	+ 96	+ 95	+ 94	+ 93	+ 91	+ 90	+ 89	+ 88	+ 86	+ 85	+ 101
+ 102	+ 102	+ 101	+ 100	+ 98	+ 97	+ 96	+ 95	+ 94	+ 92	+ 91	+ 90	+ 89	+ 87	+ 86	+ 102
+ 103	+ 103	+ 102	+ 101	+ 99	+ 98	+ 97	+ 96	+ 95	+ 93	+ 92	+ 91	+ 90	+ 88	+ 87	+ 103
+ 104	+ 104	+ 103	+ 102	+ 100	+ 99	+ 98	+ 97	+ 96	+ 94	+ 93	+ 92	+ 91	+ 89	+ 88	+ 104
+ 105		+ 104	+ 103	+ 101	+ 100	+ 99	+ 98	+ 97	+ 96	+ 94	+ 93	+ 92	+ 90	+ 89	+ 105
+ 106			+ 104	+ 102	+ 101	+ 100	+ 99	+ 98	+ 97	+ 95	+ 94	+ 93	+ 92	+ 90	+ 106
+ 107				+ 102	+ 101	+ 100	+ 99	+ 98	+ 97	+ 96	+ 95	+ 94	+ 93	+ 91	+ 107
+ 108					+ 102	+ 101	+ 100	+ 99	+ 98	+ 97	+ 96	+ 95	+ 94	+ 92	+ 108
+ 109						+ 102	+ 101	+ 100	+ 99	+ 98	+ 97	+ 96	+ 95	+ 93	+ 109
+ 110							+ 103	+ 102	+ 101	+ 99	+ 98	+ 97	+ 96	+ 94	+ 110
+ 111								+ 103	+ 102	+ 100	+ 99	+ 98	+ 97	+ 96	+ 111
+ 112									+ 103	+ 102	+ 100	+ 99	+ 98	+ 97	+ 112
+ 113										+ 103	+ 100	+ 99	+ 98	+ 97	+ 113
+ 114											+ 102	+ 101	+ 100	+ 99	+ 114
+ 115												+ 102	+ 101	+ 100	+ 115
+ 116													+ 102	+ 101	+ 116
+ 117														+ 102	+ 117
+ 118															+ 118
+ 119															+ 119
+ 120															+ 120
+ 121															+ 121
+ 122															+ 122
+ 123															+ 123
+ 124															+ 124
+ 125															+ 125
+ 126															+ 126
+ 127															+ 127
+ 128															+ 128
+ 129															+ 129
+ 130															+ 130
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE IV.

DEW POINT.

Barometric pressure, 21.0 inches.

Air temp.	Depression of the wet-bulb thermometer (t-t').															Air temp.
t	13	14	15	16	17	18	19	20	21	22	23	24	25	26	t	
+ 80	+ 61	+ 59	+ 58	+ 56	+ 54	+ 52	+ 50	+ 47	+ 45	+ 43	+ 40	+ 37	+ 34	+ 31	+ 80	
81	62	60	59	57	55	53	51	49	47	44	42	39	36	33	81	
82	63	62	60	58	56	54	52	50	48	46	44	41	38	35	82	
83	64	63	61	60	58	56	54	52	50	47	45	43	40	37	83	
84	66	64	62	61	59	57	55	53	51	49	47	44	42	39	84	
+ 85	+ 67	+ 65	+ 64	+ 62	+ 60	+ 58	+ 57	+ 55	+ 52	+ 50	+ 48	+ 46	+ 43	+ 41	+ 85	
86	68	66	65	63	62	60	58	56	54	52	50	47	45	43	86	
87	69	67	66	64	63	61	59	57	55	53	51	49	47	44	87	
88	70	69	67	66	64	62	60	59	57	55	53	50	48	46	88	
89	72	70	68	67	65	64	62	60	58	56	54	52	50	48	89	
+ 90	+ 73	+ 71	+ 70	+ 68	+ 66	+ 65	+ 63	+ 61	+ 59	+ 58	+ 56	+ 54	+ 51	+ 49	+ 90	
91	74	72	71	69	68	66	64	62	61	59	57	55	53	51	91	
92	75	73	72	70	69	67	66	64	62	61	58	56	54	52	92	
93	76	74	73	72	70	68	67	65	63	62	60	58	56	54	93	
94	77	76	74	73	71	70	68	66	65	63	61	59	57	55	94	
+ 95	+ 78	+ 77	+ 75	+ 74	+ 72	+ 71	+ 69	+ 68	+ 66	+ 64	+ 62	+ 60	+ 59	+ 57	+ 95	
96	79	78	76	75	74	72	70	69	67	65	64	62	60	58	96	
97	80	79	78	76	75	73	72	70	68	67	65	63	61	60	97	
98	82	80	79	77	76	74	73	71	70	68	66	65	63	61	98	
99	83	81	80	78	77	76	74	72	71	69	68	66	64	62	99	
+100	+ 84	+ 82	+ 81	+ 80	+ 78	+ 77	+ 75	+ 74	+ 72	+ 70	+ 69	+ 67	+ 65	+ 64	+100	
101	85	83	82	81	79	78	76	75	73	72	70	68	67	65	101	
102	86	84	83	82	80	79	78	76	74	73	71	70	68	66	102	
103	87	86	84	83	82	80	79	77	76	74	73	71	69	68	103	
104	88	87	85	84	83	81	80	78	77	75	74	72	71	69	104	
+105	+ 89	+ 88	+ 86	+ 85	+ 84	+ 82	+ 81	+ 80	+ 78	+ 77	+ 75	+ 74	+ 72	+ 70	+105	
106	90	89	88	86	85	84	82	81	79	78	76	75	73	72	106	
107	91	90	89	87	86	85	83	82	80	79	77	76	74	73	107	
108	92	91	90	88	87	86	84	83	82	80	79	77	76	74	108	
109	93	92	91	90	88	87	86	84	83	81	80	78	77	75	109	
+110	+ 94	+ 93	+ 92	+ 91	+ 89	+ 88	+ 87	+ 85	+ 84	+ 82	+ 81	+ 80	+ 78	+ 76	+110	
111	96	94	93	92	90	89	88	86	85	84	82	81	79	78	111	
112	97	95	94	93	92	90	89	88	86	85	83	82	80	79	112	
113	98	96	95	94	93	91	90	89	87	86	84	83	82	80	113	
114	99	98	96	95	94	92	91	90	88	87	86	84	83	81	114	
+115	+100	+ 99	+ 97	+ 96	+ 95	+ 94	+ 92	+ 91	+ 90	+ 88	+ 87	+ 85	+ 84	+ 82	+115	
116	101	100	98	97	96	95	93	92	91	89	88	86	85	84	116	
117	102	101	100	98	97	96	94	93	92	90	89	88	86	85	117	
118		102	101	99	98	97	96	94	93	92	90	89	88	86	118	
119			102	100	99	98	97	95	94	93	91	90	89	87	119	
+120				+101	+100	+ 99	+ 98	+ 96	+ 95	+ 94	+ 92	+ 91	+ 90	+ 88	+120	
121				104	100	100	99	98	96	95	94	92	91	90	121	
122					101	100	99	97	96	95	93	92	91	90	122	
123						101	100	98	97	96	94	93	92	91	123	
124							101	100	98	97	96	94	93	92	124	
+125								+101	+ 99	+ 98	+ 97	+ 95	+ 94	+125		
126									100	99	98	97	95	94	126	
127										100	99	98	96	95	127	
128											100	99	98	96	128	
129												100	99	98	129	
+130														+100	+130	
	13	14	15	16	17	18	19	20	21	22	23	24	25	26		

TABLE V.

DEW POINT.

Barometric pressure, 18.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	
-20	-20	-31													-20
19	19	29													19
18	18	27													18
17	17	26													17
-16	-16	-24													-16
-15	-15	-23													-15
14	14	22													14
13	13	20	-31												13
12	12	19	29												12
-11	-11	-18	-27												-11
-10	-10	-17	-25												-10
9	9	15	24												9
8	8	14	22												8
7	7	13	20	-30											7
-6	-6	-12	-19	-28											-6
-5	-5	-11	-17	-26											-5
4	4	9	16	24											4
3	3	8	14	22											3
2	2	7	12	20	-31										2
-1	-1	-6	-11	-18	-28										-1
0	0	4	-10	-16	-25										0
+1	+1	3	8	15	23										+1
2	2	2	7	13	21										2
3	3	1	6	11	18	-30									3
4	4	0	-5	-10	-16	-27									4
+5	+5	+1	-3	-8	-14	-24									+5
6	6	2	7	13	21										6
7	7	3	-1	6	11	19	-30								7
8	8	4	0	4	9	16	27								8
9	9	6	+2	-3	-7	-14	-24								9
+10	+10	+7	+3	-1	-6	-12	-21								+10
11	11	8	4	0	4	10	18	-29							11
12	12	9	6	+2	3	8	16	25							12
13	13	10	7	3	-1	6	13	22							13
14	14	11	8	4	0	-5	-11	-19	-30						14
+15	+15	+12	+9	+6	+2	-3	-9	-16	-26						+15
16	16	43	10	7	3	-2	7	13	22						16
17	17	14	11	8	5	0	5	11	19						17
18	18	16	13	10	6	+2	3	9	16	-27					18
19	19	17	14	11	8	4	-1	-6	-13	-23					19
+20	+20	+18	+15	+12	+9	+5	+1	-4	-10	-19					+20
21	21	19	16	14	10	7	3	2	8	16	-28				21
22	22	20	17	15	12	8	4	-1	6	13	23				22
23	23	21	18	16	13	10	6	+2	3	10	19				23
24	24	22	19	17	14	11	8	+4	-1	-7	-15	-27			24
+25	+25	+23	+20	+18	+16	+12	+9	+5	+1	-5	-12	-22			+25
26	26	24	22	19	17	14	11	7	3	-2	9	18	-30		26
27	27	25	23	20	18	15	12	9	5	0	6	14	24		27
28	28	26	24	22	19	16	14	10	7	+2	3	10	20		28
29	29	27	25	23	20	18	15	12	8	4	-1	-7	-15	-28	29
+30	+30	+28	+26	+24	+22	+19	+16	+13	+10	+6	+1	-4	-11	-22	+30
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE V.

DEW POINT.

Barometric pressure, 18.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	
+30	+30	+28	+26	+24	+22	+19	+16	+13	+10	+ 6	+ 1	- 4	-11	-22	+30
31	31	29	27	25	23	20	18	15	12	8	3	- 2	5	17	31
32	32	30	28	26	24	22	19	16	14	10	6	+ 1	8	13	32
33	33	31	29	27	25	23	20	18	15	11	8	3	- 2	9	33
34	34	32	30	28	26	24	22	19	16	13	10	5	0	- 6	34
+35	+35	+33	+31	+29	+27	+25	+23	+20	+18	+15	+11	+ 7	+ 3	- 3	+35
36	36	34	32	30	27	26	24	22	19	16	13	9	5	0	36
37	37	35	33	31	28	26	25	23	20	18	15	11	7	+ 2	37
38	38	36	34	32	30	27	25	24	22	19	16	13	9	5	38
39	39	37	35	33	31	28	26	24	23	21	18	15	11	7	39
+40	+40	+38	+36	+34	+32	+30	+27	+25	+22	+20	+19	+16	+13	+ 9	+40
41	41	39	37	35	33	31	28	26	24	21	20	18	15	11	41
42	42	40	38	36	34	32	30	27	25	22	19	20	17	13	42
43	43	41	39	37	35	33	31	29	26	24	20	17	15	15	43
44	44	42	40	38	36	34	32	30	28	25	22	19	16	17	44
+45	+45	+43	+41	+40	+38	+36	+33	+31	+29	+26	+24	+20	+17	+14	+45
46	46	44	42	41	39	37	34	32	30	28	25	22	19	15	46
47	47	45	44	42	40	38	36	34	31	29	26	24	21	17	47
48	48	46	45	43	41	39	37	35	32	30	28	25	22	19	48
49	49	47	46	44	42	40	38	36	34	31	29	26	24	20	49
+50	+50	+48	+47	+45	+43	+41	+39	+37	+35	+33	+30	+28	+25	+22	+50
51	51	49	48	46	44	42	40	38	36	34	32	29	26	24	51
52	52	50	49	47	45	44	42	40	38	35	33	30	28	25	52
53	53	51	50	48	46	45	43	41	39	37	34	32	29	27	53
54	54	52	51	49	48	46	44	42	40	38	36	33	31	28	54
+55	+55	+53	+52	+50	+49	+47	+45	+43	+41	+39	+37	+35	+32	+30	+55
56	56	54	53	51	50	48	46	44	42	40	38	36	34	31	56
57	57	55	54	52	51	49	47	46	44	42	40	37	35	33	57
58	58	56	55	53	52	50	48	47	45	43	41	39	36	34	58
59	59	57	56	54	53	51	50	48	46	44	42	40	38	36	59
+60	+60	+59	+57	+56	+54	+52	+51	+49	+47	+45	+43	+41	+39	+37	+60
61	61	60	58	57	55	53	52	50	48	46	44	43	41	38	61
62	62	61	59	58	56	54	53	51	50	48	46	44	42	40	62
63	63	62	60	59	57	56	54	52	51	49	47	45	43	41	63
64	64	63	61	60	58	57	55	53	52	50	48	46	44	42	64
+65	+65	+64	+62	+61	+59	+58	+56	+54	+53	+51	+49	+48	+46	+44	+65
66	66	65	63	62	60	59	57	56	54	52	50	49	47	45	66
67	67	66	64	63	61	60	58	57	55	54	52	50	48	46	67
68	68	67	65	64	62	61	59	58	56	55	53	51	49	48	68
69	69	68	66	65	63	62	60	59	57	56	54	52	51	49	69
+70	+70	+69	+67	+66	+64	+63	+62	+60	+58	+57	+55	+54	+52	+50	+70
71	71	70	68	67	66	64	63	61	60	58	56	55	53	51	71
72	72	71	69	68	67	65	64	62	61	59	58	56	54	52	72
73	73	72	70	69	68	66	65	63	62	60	59	57	55	54	73
74	74	73	71	70	69	67	66	64	63	61	60	58	57	55	74
+75	+75	+74	+72	+71	+70	+68	+67	+65	+64	+62	+61	+59	+58	+56	+75
76	76	75	73	72	71	69	68	66	65	64	62	60	59	57	76
77	77	76	74	73	72	70	69	68	66	65	63	62	60	58	77
78	78	77	75	74	73	71	70	69	67	66	64	63	61	60	78
79	79	78	76	75	74	72	71	70	68	67	65	64	62	61	79
+80	+80	+79	+77	+76	+75	+74	+72	+71	+69	+68	+66	+65	+64	+62	+80
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE V.

DEW POINT.

Barometric pressure, 18.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
+30	-22														+30
31	17														31
32	13	-25													32
33	9	20													33
34	-6	-15	-27												34
+35	-3	-10	-21												+35
36	0	7	16	-29											36
37	+2	4	11	22											37
38	5	-1	7	16											38
39	7	+2	-4	-12	-24										39
+40	+9	+5	-1	-8	-18										+40
41	11	7	+2	4	13	-26									41
42	13	9	5	-1	8	19									42
43	15	11	7	+2	4	13	-26								43
44	17	13	9	5	-1	-9	-19								44
+45	+14	+15	+12	+7	+2	-5	-13	-27							+45
46	15	11	14	10	5	-1	8	19							46
47	17	13	9	12	7	+2	4	13	-28						47
48	19	15	11	6	10	5	-1	8	20						48
49	20	17	13	9	3	8	+2	-4	-14	-28					49
+50	+22	+19	+15	+11	+6	-1	+5	-1	-8	-20					+50
51	24	21	17	13	8	+2	-5	+3	4	14	-28				51
52	25	22	19	15	11	6	-1	-10	0	8	20				52
53	27	24	21	17	13	8	+2	6	-18	4	13	-27			53
54	28	25	22	19	16	11	6	-1	-11	-28	-8	-19			54
+55	+30	+27	+24	+21	+18	+13	+8	+2	-6	-19	-12	-27			+55
56	31	28	26	23	19	16	11	6	-2	12	-29	-18			56
57	33	30	27	24	21	18	14	9	+2	6	19				57
58	34	31	29	26	23	20	16	12	6	-2	12	29			58
59	36	33	30	28	25	22	18	14	9	+2	-6	-19			59
+60	+37	+34	+32	+29	+26	+23	+20	+16	+12	+6	-1	-11	-30		+60
61	38	36	34	31	28	25	22	18	14	9	+3	6	19	-30	61
62	40	37	35	32	30	27	24	20	17	12	6	-1	11		62
63	41	39	36	34	31	29	26	22	19	15	10	+3	-5	19	63
64	42	40	38	36	34	30	27	24	21	17	12	7	0	-11	64
+65	+44	+42	+39	+37	+35	+32	+29	+26	+23	+19	+15	+10	+4	-5	+65
66	45	43	41	38	36	34	31	28	25	21	18	13	8	0	66
67	46	44	42	40	38	35	32	30	27	23	20	16	11	+4	67
68	48	46	44	41	39	37	34	31	28	25	22	18	14	8	68
69	49	47	45	43	40	38	36	33	30	27	24	20	16	11	69
+70	+50	+48	+46	+44	+42	+40	+37	+35	+32	+29	+26	+23	+19	+14	+70
71	51	49	48	46	44	41	39	36	34	31	28	25	21	17	71
72	52	51	49	47	45	43	40	38	35	32	30	27	23	19	72
73	54	52	50	48	46	44	42	40	37	34	32	28	25	22	73
74	55	53	51	50	48	45	43	41	39	36	33	30	27	24	74
+75	+56	+54	+53	+51	+49	+47	+45	+43	+40	+38	+35	+32	+29	+26	+75
76	57	56	54	52	50	48	46	44	42	39	37	34	31	28	76
77	58	57	55	53	51	50	48	46	44	42	38	36	33	30	77
78	60	58	56	54	53	51	49	47	45	42	40	38	35	32	78
79	61	59	58	56	54	52	50	48	46	44	41	39	37	34	79
+80	+62	+60	+59	+57	+55	+54	+52	+50	+48	+46	+43	+41	+38	+36	+80
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	

TABLE V.

DEW POINT.

Barometric pressure 18.0 inches.

Air temp.	Depression of the wet-bulb thermometer (t-t').														Air temp.
t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	t
+ 80	+ 80	+ 79	+ 77	+ 76	+ 75	+ 74	+ 72	+ 71	+ 69	+ 68	+ 66	+ 65	+ 64	+ 62	+ 80
81	81	80	78	77	76	75	73	72	70	69	68	66	65	63	81
82	82	81	79	78	77	76	74	73	72	70	69	67	66	64	82
83	83	82	80	79	78	77	75	74	73	71	70	68	67	65	83
84	84	83	81	80	79	78	76	75	74	72	71	70	68	66	84
+ 85	+ 85	+ 84	+ 82	+ 81	+ 80	+ 79	+ 77	+ 76	+ 75	+ 73	+ 72	+ 71	+ 69	+ 68	+ 85
86	86	85	83	82	81	80	78	77	76	74	73	72	70	69	86
87	87	86	85	83	82	81	80	78	77	76	74	73	71	70	87
88	88	87	86	84	83	82	81	79	78	77	75	74	72	71	88
89	89	88	87	85	84	83	82	80	79	78	76	75	74	72	89
+ 90	+ 90	+ 89	+ 88	+ 86	+ 85	+ 84	+ 83	+ 81	+ 80	+ 79	+ 77	+ 76	+ 75	+ 73	+ 90
91	91	90	89	87	86	85	84	82	81	80	78	77	76	74	91
92	92	91	90	88	87	86	85	83	82	81	80	78	77	76	92
93	93	92	91	89	88	87	86	84	83	82	81	79	78	77	93
94	94	93	92	90	89	88	87	86	84	83	82	80	79	78	94
+ 95	+ 95	+ 94	+ 93	+ 91	+ 90	+ 89	+ 88	+ 87	+ 85	+ 84	+ 83	+ 81	+ 80	+ 79	+ 95
96	96	95	94	92	91	90	89	88	86	85	84	82	81	80	96
97	97	96	95	93	92	91	90	89	87	86	85	84	82	81	97
98	98	97	96	94	93	92	91	90	88	87	86	85	83	82	98
99	99	98	97	95	94	93	92	91	89	88	87	86	84	83	99
+100	+100	+ 99	+ 98	+ 96	+ 95	+ 94	+ 93	+ 92	+ 90	+ 89	+ 88	+ 87	+ 86	+ 84	+100
101	101	100	99	97	96	95	94	93	92	90	89	88	87	85	101
102	102	101	100	98	97	96	95	94	93	91	90	89	88	86	102
103	103	102	101	100	98	97	96	95	94	92	91	90	89	87	103
104	104	103	102	101	99	98	97	96	95	94	92	91	90	88	104
+105		+104	+103	+102	+100	+ 99	+ 98	+ 97	+ 96	+ 95	+ 93	+ 92	+ 91	+ 90	+105
106			104	103	101	100	99	98	97	96	94	93	92	91	106
107				104	102	101	100	99	98	97	95	94	93	92	107
108					103	102	101	100	99	98	96	95	94	93	108
109						103	102	101	100	99	97	96	95	94	109
+110							+103	+102	+101	+100	+ 98	+ 97	+ 96	+ 95	+110
111								103	102	101	100	98	97	96	111
112									103	102	101	99	98	97	112
113										103	102	100	99	98	113
114											103	101	100	99	114
+115												+102	+101	+100	+115
116													102	101	116
117														102	117
118															118
119															119
+120															+120
121															121
122															122
123															123
124															124
+125															+125
126															126
127															127
128															128
129															129
+130															+130
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE V.

DEW POINT.

Barometric pressure 18.0 inches.

Air temp. t	Depression of the wet-bulb thermometer (t-t').														Air temp. t
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
+ 80	+ 62	+ 60	+ 59	+ 57	+ 55	+ 54	+ 52	+ 50	+ 48	+ 46	+ 43	+ 41	+ 38	+ 36	+ 80
81	63	62	60	58	56	55	53	51	49	47	45	43	40	37	81
82	64	63	61	60	58	56	54	52	50	48	46	44	42	39	82
83	65	64	62	61	59	57	56	54	52	50	48	46	43	41	83
84	66	65	64	62	60	58	57	55	53	51	49	47	45	43	84
+ 85	+ 68	+ 66	+ 65	+ 63	+ 61	+ 60	+ 58	+ 56	+ 54	+ 53	+ 51	+ 49	+ 46	+ 44	+ 85
86	69	67	66	64	63	61	59	58	56	54	52	50	48	46	86
87	70	68	67	65	64	62	61	59	57	55	53	52	49	47	87
88	71	70	68	67	65	64	62	60	58	57	55	53	51	49	88
89	72	71	69	68	66	65	63	61	60	58	56	54	52	50	89
+ 90	+ 73	+ 72	+ 70	+ 69	+ 67	+ 66	+ 64	+ 63	+ 61	+ 59	+ 58	+ 56	+ 54	+ 52	+ 90
91	74	73	72	70	69	67	66	64	62	60	59	57	55	53	91
92	76	74	73	71	70	68	67	65	64	62	60	58	56	55	92
93	77	75	74	72	71	69	68	66	65	63	61	60	58	56	93
94	78	76	75	74	72	71	69	68	66	64	63	61	59	57	94
+ 95	+ 79	+ 77	+ 76	+ 75	+ 73	+ 72	+ 70	+ 69	+ 67	+ 66	+ 64	+ 62	+ 60	+ 59	+ 95
96	80	78	77	76	74	73	71	70	68	67	65	64	62	60	96
97	81	80	78	77	76	74	73	71	70	68	66	65	63	61	97
98	82	81	79	78	77	75	74	72	71	69	68	66	64	63	98
99	83	82	80	79	78	76	75	74	72	70	69	67	66	64	99
+100	+ 84	+ 83	+ 82	+ 80	+ 79	+ 77	+ 76	+ 75	+ 73	+ 72	+ 70	+ 69	+ 67	+ 65	+100
101	85	84	83	81	80	79	77	76	74	73	71	70	68	67	101
102	86	85	84	82	81	80	78	77	76	74	72	71	70	68	102
103	87	86	85	84	82	81	80	78	77	75	74	72	71	69	103
104	88	87	86	85	83	82	81	79	78	76	75	73	72	70	104
+105	+ 90	+ 88	+ 87	+ 86	+ 84	+ 83	+ 82	+ 80	+ 79	+ 78	+ 76	+ 75	+ 73	+ 72	+105
106	91	89	88	87	86	84	83	82	80	79	77	76	74	73	106
107	92	90	89	88	87	85	84	83	81	80	78	77	76	74	107
108	93	92	90	89	88	86	85	84	82	81	80	78	77	75	108
109	94	93	91	90	89	88	86	85	84	82	81	79	78	76	109
+110	+ 95	+ 94	+ 92	+ 91	+ 90	+ 89	+ 87	+ 86	+ 85	+ 83	+ 82	+ 80	+ 79	+ 78	+110
111	96	95	93	92	91	90	88	87	86	84	83	82	80	79	111
112	97	96	94	93	92	91	90	88	87	86	84	83	81	80	112
113	98	97	96	94	93	92	91	89	88	87	85	84	83	81	113
114	99	98	97	95	94	93	92	90	89	88	86	85	84	82	114
+115	+100	+ 99	+ 98	+ 96	+ 95	+ 94	+ 93	+ 92	+ 90	+ 89	+ 88	+ 86	+ 85	+ 84	+115
116	101	100	99	98	96	95	94	93	91	90	89	87	86	85	116
117	102	101	100	99	97	96	95	94	92	91	90	88	87	86	117
118		102	101	100	98	97	96	95	94	92	91	90	88	87	118
119			102	101	100	98	97	96	95	93	92	91	89	88	119
+120				+102	+101	+ 99	+ 98	+ 97	+ 96	+ 94	+ 93	+ 92	+ 90	+ 89	+120
121					102	100	99	98	97	96	94	93	92	90	121
122						102	100	99	98	97	95	94	93	92	122
123							101	100	99	98	96	95	94	93	123
124								101	100	99	98	96	95	94	124
+125									+101	+100	+ 99	+ 97	+ 96	+ 95	+125
126										101	100	99	98	97	126
127											101	100	99	98	127
128												101	100	99	128
129													100	99	129
+130														+100	+130
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	

TABLE VI.

RELATIVE HUMIDITY.

For all latitudes, elevations, and pressures.

Air temp. °	Depression of the dew-point (t-d).														Air temp. °
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	
— 68	100	P. et.	P. et.	P. et.	P. et.	P. et.	P. et.	P. et.	P. et.	P. et.	P. et.	P. et.	P. et.	P. et.	— 68
— 64	100														— 64
— 60	100	64	29												— 60
— 56	100	84	68	53	38	24	11								— 56
— 52	100	89	78	68	58	48	39	31	22	14	6				— 52
— 48	100	91	83	74	67	59	52	45	38	32	27	21	15	9	— 48
— 44	100	92	85	78	72	65	59	53	48	42	37	32	28	23	— 44
— 40	100	93	87	81	75	69	64	59	54	49	44	40	36	32	— 40
— 36	100	94	87	82	77	72	67	62	58	53	49	45	41	37	— 36
— 32	100	94	88	83	79	74	69	65	61	57	53	49	45	42	— 32
— 28	100	94	89	84	80	75	71	67	63	59	55	52	48	45	— 28
— 24	100	95	90	85	80	76	72	68	64	61	57	53	50	47	— 24
— 20	100	95	90	85	80	76	72	68	64	60	57	53	51	48	— 20
— 16	100	95	90	86	81	77	73	69	65	62	58	55	52	49	— 16
— 12	100	95	90	86	82	78	74	70	67	63	60	57	54	50	— 12
— 8	100	95	91	86	82	78	74	71	67	64	61	58	55	52	— 8
— 4	100	95	91	87	83	79	75	71	68	65	62	58	56	53	— 4
0	100	95	91	87	83	79	75	72	68	65	62	59	56	54	0
+ 4	100	96	91	87	83	79	76	72	69	66	63	60	57	54	+ 4
8	100	96	91	87	83	80	76	73	69	66	63	60	58	55	8
+ 12	100	96	91	87	83	80	76	73	70	66	64	61	58	55	+ 12
16	100	96	91	87	83	80	76	73	70	67	64	61	58	56	16
20	100	96	91	87	84	80	76	73	70	67	64	61	58	56	20
24	100	96	92	88	84	80	76	73	70	67	64	61	58	56	24
28	100	96	92	88	84	80	77	74	70	67	64	61	59	56	28
+ 32	100	96	92	88	85	81	78	74	71	68	65	62	60	57	+ 32
36	100	96	92	89	85	82	79	75	72	69	66	64	61	58	36
40	100	96	92	89	86	82	79	76	73	70	67	65	62	59	40
44	100	96	93	89	86	83	80	76	74	71	68	65	63	60	44
48	100	96	93	89	86	83	80	77	74	71	68	66	63	61	48
+ 52	100	96	93	90	86	83	80	77	74	72	69	66	64	61	+ 52
56	100	96	93	90	86	83	80	77	74	72	69	67	64	62	56
60	100	96	93	90	87	84	81	78	75	72	70	67	65	62	60
64	100	97	93	90	87	84	81	78	75	73	70	68	65	63	64
68	100	97	93	90	87	84	81	78	76	73	70	68	66	63	68
+ 72	100	97	94	90	87	84	82	79	76	73	71	68	66	64	+ 72
76	100	97	94	90	88	85	82	79	76	74	71	69	66	64	76
80	100	97	94	91	88	85	82	79	77	74	72	69	67	65	80
84	100	97	94	91	88	85	82	80	77	74	72	70	67	65	84
88	100	97	94	91	88	85	82	80	77	75	72	70	68	66	88
+ 92	100	97	94	91	88	85	83	80	78	75	73	70	68	66	+ 92
96	100	97	94	91	88	86	83	80	78	76	73	71	69	66	96
100	100	97	94	91	88	86	83	81	78	76	74	71	69	67	100
104	100	97	94	91	89	86	84	81	79	76	74	72	69	67	104
108	100	97	94	92	89	86	84	81	79	76	74	72	70	68	108
+ 112	100	97	94	92	89	86	84	82	79	77	74	72	70	68	+ 112
116	100	97	94	92	89	87	84	82	80	77	75	73	71	68	116
120	100	97	95	92	89	87	84	82	80	77	75	73	71	69	120
124	100	97	95	92	90	87	85	82	80	78	76	74	71	69	124
128	100	97	95	92	90	87	85	82	80	78	76	74	72	70	128
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	

TABLE VI.

RELATIVE HUMIDITY.

For all latitudes, elevations, and pressures.

Air temp.	Depression of the dew-point (t—d).															Air temp.
t	13	14	15	16	17	18	19	20	21	22	23	24	25	26	t	
	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.		
— 68															— 68	
— 64															— 64	
— 60															— 60	
— 56															— 56	
— 52															— 52	
— 48	9	4													— 48	
— 44	23	19	15	11	7	3									— 44	
— 40	32	28	24	21	17	14	11	8	5	2					— 40	
— 36	37	34	31	28	24	21	18	16	13	11	8	6	4	2	— 36	
— 32	42	39	35	32	29	27	24	22	19	17	14	12	10	8	— 32	
— 28	45	42	39	36	33	31	28	26	23	21	19	17	15	13	— 28	
— 24	47	44	41	38	36	33	31	29	26	24	22	21	19	17	— 24	
— 20	48	45	43	40	38	35	34	32	29	27	25	23	21	20	— 20	
— 16	49	46	44	41	40	37	35	33	31	29	27	25	23	22	— 16	
— 12	50	47	45	42	41	38	36	34	32	30	28	27	25	24	— 12	
— 8	52	49	46	44	42	39	37	35	33	31	29	28	26	25	— 8	
— 4	53	50	48	45	43	41	38	36	34	32	31	29	27	26	— 4	
0	54	51	48	46	44	42	39	37	36	34	32	30	29	27	0	
+ 4	54	52	49	47	45	42	40	38	36	35	33	31	30	28	+ 4	
8	55	52	50	48	45	43	41	39	37	35	34	32	30	29	8	
+ 12	55	53	50	48	46	44	42	40	38	36	34	32	31	30	+ 12	
16	56	53	51	48	46	44	42	40	38	36	35	33	32	30	16	
20	56	53	51	48	46	44	42	40	38	37	35	33	32	30	20	
24	56	53	51	48	46	44	42	40	39	37	35	34	32	31	24	
28	56	54	51	49	47	45	43	41	39	37	36	34	32	31	28	
+ 32	57	54	52	50	47	45	43	41	40	38	36	34	33	32	+ 32	
36	58	56	53	51	49	46	44	42	40	39	37	35	34	33	36	
40	59	57	54	52	50	48	46	43	42	40	38	36	35	33	40	
44	60	58	56	53	51	49	47	45	43	41	39	37	36	34	44	
48	61	58	56	54	52	50	48	46	44	42	40	38	37	35	48	
+ 52	61	59	57	55	52	50	48	47	44	43	41	40	38	36	+ 52	
56	62	60	57	55	53	51	49	47	45	44	42	40	39	37	56	
60	62	60	58	56	54	52	50	48	46	44	42	41	39	38	60	
64	63	60	58	56	54	52	50	48	47	45	43	42	40	39	64	
68	63	61	59	57	55	53	51	49	47	45	44	42	40	39	68	
+ 72	64	62	59	57	55	53	51	50	48	46	44	43	41	40	+ 72	
76	64	62	60	58	56	54	52	50	48	47	45	43	42	41	76	
80	65	62	60	58	56	54	52	51	49	47	46	44	42	41	80	
84	65	63	61	59	57	55	53	51	49	48	46	44	43	42	84	
88	66	63	61	59	57	55	54	52	50	48	47	45	44	43	88	
+ 92	66	64	62	60	58	56	54	52	50	49	47	46	44	43	+ 92	
96	66	64	62	60	58	56	55	53	51	49	48	46	45	44	96	
100	67	65	63	61	59	57	55	53	52	50	48	47	45	44	100	
104	67	65	63	61	59	58	56	54	53	51	49	47	46	45	104	
108	68	66	64	62	60	58	56	54	53	51	49	48	46	45	108	
+112	68	66	64	62	60	58	57	55	54	52	50	48	47	46	+112	
116	68	66	64	63	61	59	57	56	54	52	50	49	48	47	116	
120	69	67	65	63	61	60	58	56	54	52	51	50	48	47	120	
124	69	67	65	64	62	60	58	56	55	53	51	50	49	48	124	
128	70	68	66	64	62	60	59	57	55	53	52	51	49	48	128	
	13	14	15	16	17	18	19	20	21	22	23	24	25	26		

TABLE VI.

RELATIVE HUMIDITY.

For all latitudes, elevations, and pressures.

Air temp. t	Depression of the dew-point (t-d).											Air temp. t
	20	24	28	32	36	40	44	48	52	56	60	
- 68	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	- 68
- 64												- 64
- 60												- 60
- 56												- 56
- 52												- 52
- 48												- 48
- 44												- 44
- 40	8											- 40
- 36	16	6										- 36
- 32	22	12	5									- 32
- 28	26	17	10	4								- 28
- 24	29	21	14	8	3							- 24
- 20	32	23	17	11	7	3						- 20
- 16	33	25	19	13	9	5						- 16
- 12	34	27	21	15	11	7	3					- 12
- 8	35	28	23	17	13	9	5	4				- 8
- 4	36	29	24	19	15	11	7	6	3			- 4
0	37	30	25	20	16	12	9	7	4	3		0
+ 4	38	31	26	21	17	13	10	8	5	4		+ 4
+ 8	39	32	27	22	18	14	11	9	6	5	3	+ 8
+ 12	40	33	27	23	18	14	11	10	7	6	4	+ 12
+ 16	40	33	27	23	18	15	12	10	7	6		+ 16
+ 20	40	33	28	23	19	15	12	10	8	6	5	+ 20
+ 24	40	34	28	23	19	15	13	11	8	7	5	+ 24
+ 28	41	34	28	23	19	16	13	11	9	7	6	+ 28
+ 32	41	34	29	24	20	16	14	11	9	7	6	+ 32
+ 36	42	35	30	25	20	17	14	12	10	8	6	+ 36
+ 40	43	36	30	25	21	18	14	12	10	8	6	+ 40
+ 44	45	37	31	26	22	18	15	12	10	8	7	+ 44
+ 48	46	38	32	27	22	19	16	13	11	9	7	+ 48
+ 52	47	40	33	28	23	19	16	13	11	9	8	+ 52
+ 56	47	40	34	29	24	20	17	14	12	10	8	+ 56
+ 60	48	41	35	30	25	21	17	14	12	10	8	+ 60
+ 64	48	42	36	30	26	22	18	15	12	10	9	+ 64
+ 68	49	42	36	31	26	22	19	16	13	11	9	+ 68
+ 72	50	43	37	32	27	23	19	16	14	11	10	+ 72
+ 76	50	43	37	32	28	24	20	17	14	12	10	+ 76
+ 80	51	44	38	33	28	24	21	18	15	13	10	+ 80
+ 84	51	44	39	33	29	25	21	18	16	13	11	+ 84
+ 88	52	45	39	34	29	25	22	19	16	14	12	+ 88
+ 92	52	46	40	34	30	26	22	19	16	14	12	+ 92
+ 96	53	46	40	35	30	26	23	20	17	15	12	+ 96
+ 100	53	47	41	36	31	27	23	20	17	15	13	+ 100
+ 104	54	47	41	36	32	28	24	21	18	16	13	+ 104
+ 108	54	48	42	37	32	28	24	21	18	16	14	+ 108
+ 112	55	49	43	37	33	29	25	22	19	16	14	+ 112
+ 116	56	49	43	38	33	29	26	22	20	17	15	+ 116
+ 120	56	50	44	39	34	30	26	23	20	18	15	+ 120
+ 124	56	50	44	39	35	30	27	23	20	18	16	+ 124
+ 128	57	51	45	40	35	31	27	24	21	18	16	+ 128
	20	24	28	32	36	40	44	48	52	56	60	

TABLE VII.

For reduction of barometric observations to freezing-point.

331. In using the table, find at the top of the page the observed height of the barometer, and in the column at the left, the reading of the attached thermometer. The number at the intersection of these lines will be the correction to be applied.

If the reading of the thermometer is less than 29° above zero, the correction will be *added* to the original observation, but if 29° or more above zero, it will be *subtracted*.

If the exact reading of the barometer cannot be found at the head of any column, the nearest number to it will be taken. The result in such cases will be approximately correct.

TABLE VII.—Reduction of barometric readings to the freezing-point—Add.

—30° to —0°

Attached thermometer.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
22	Inch.	22.5	23	23.5	24	24.5	25	25.5	26	26.5	27	27.5	28	28.5	29	29.5	30	30.5	31	Inch.
Degrees.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
30	+ .116	+ .119	+ .121	+ .124	+ .127	+ .129	+ .132	+ .135	+ .137	+ .140	+ .143	+ .145	+ .148	+ .150	+ .153	+ .156	+ .158	+ .161	+ .164	Inch.
29	+ .114	+ .117	+ .119	+ .122	+ .125	+ .127	+ .130	+ .132	+ .135	+ .137	+ .140	+ .143	+ .145	+ .148	+ .151	+ .153	+ .156	+ .158	+ .161	Inch.
28	+ .112	+ .115	+ .117	+ .120	+ .122	+ .125	+ .127	+ .130	+ .132	+ .135	+ .138	+ .140	+ .143	+ .145	+ .148	+ .150	+ .153	+ .155	+ .158	Inch.
27	+ .110	+ .113	+ .115	+ .118	+ .120	+ .123	+ .125	+ .128	+ .130	+ .133	+ .135	+ .138	+ .140	+ .143	+ .145	+ .148	+ .150	+ .153	+ .155	Inch.
26	+ .108	+ .111	+ .113	+ .116	+ .118	+ .121	+ .123	+ .125	+ .128	+ .130	+ .133	+ .135	+ .138	+ .140	+ .143	+ .145	+ .147	+ .150	+ .152	Inch.
25	+ .106	+ .109	+ .111	+ .113	+ .116	+ .118	+ .121	+ .123	+ .125	+ .128	+ .130	+ .133	+ .135	+ .138	+ .140	+ .142	+ .145	+ .147	+ .150	Inch.
24	+ .104	+ .107	+ .109	+ .111	+ .114	+ .116	+ .118	+ .121	+ .123	+ .125	+ .128	+ .130	+ .133	+ .135	+ .137	+ .140	+ .142	+ .144	+ .147	Inch.
23	+ .102	+ .104	+ .107	+ .109	+ .111	+ .114	+ .116	+ .118	+ .121	+ .123	+ .125	+ .128	+ .130	+ .132	+ .135	+ .137	+ .139	+ .142	+ .144	Inch.
22	+ .100	+ .102	+ .105	+ .107	+ .109	+ .112	+ .114	+ .116	+ .118	+ .121	+ .123	+ .125	+ .128	+ .130	+ .132	+ .135	+ .137	+ .139	+ .141	Inch.
21	+ .098	+ .100	+ .103	+ .105	+ .107	+ .109	+ .112	+ .114	+ .116	+ .118	+ .121	+ .123	+ .125	+ .128	+ .130	+ .132	+ .134	+ .136	+ .138	Inch.
20	+ .096	+ .098	+ .101	+ .103	+ .105	+ .107	+ .109	+ .111	+ .113	+ .115	+ .118	+ .120	+ .122	+ .125	+ .127	+ .129	+ .131	+ .133	+ .135	Inch.
19	+ .094	+ .096	+ .098	+ .101	+ .103	+ .105	+ .107	+ .109	+ .111	+ .113	+ .115	+ .118	+ .120	+ .122	+ .124	+ .126	+ .128	+ .130	+ .132	Inch.
18	+ .092	+ .094	+ .096	+ .098	+ .101	+ .103	+ .105	+ .107	+ .109	+ .111	+ .113	+ .115	+ .117	+ .119	+ .121	+ .123	+ .125	+ .127	+ .129	Inch.
17	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .103	+ .105	+ .107	+ .109	+ .111	+ .113	+ .115	+ .117	+ .119	+ .121	+ .123	+ .125	+ .127	Inch.
16	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	+ .108	+ .110	+ .112	+ .114	+ .116	+ .118	+ .120	+ .122	+ .124	Inch.
15	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	+ .108	+ .110	+ .112	+ .114	+ .116	+ .118	+ .120	+ .122	Inch.
14	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	+ .108	+ .110	+ .112	+ .114	+ .116	+ .118	+ .120	Inch.
13	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	+ .108	+ .110	+ .112	+ .114	+ .116	+ .118	Inch.
12	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	+ .108	+ .110	+ .112	+ .114	+ .116	Inch.
11	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	+ .108	+ .110	+ .112	+ .114	Inch.
10	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	+ .108	+ .110	+ .112	Inch.
9	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	+ .108	+ .110	Inch.
8	+ .072	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	+ .108	Inch.
7	+ .070	+ .072	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	+ .106	Inch.
6	+ .068	+ .070	+ .072	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	+ .104	Inch.
5	+ .066	+ .068	+ .070	+ .072	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	+ .102	Inch.
4	+ .064	+ .066	+ .068	+ .070	+ .072	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	+ .100	Inch.
3	+ .062	+ .064	+ .066	+ .068	+ .070	+ .072	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	+ .098	Inch.
2	+ .060	+ .062	+ .064	+ .066	+ .068	+ .070	+ .072	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	+ .096	Inch.
1	+ .058	+ .060	+ .062	+ .064	+ .066	+ .068	+ .070	+ .072	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	+ .094	Inch.
0	+ .056	+ .058	+ .060	+ .062	+ .064	+ .066	+ .068	+ .070	+ .072	+ .074	+ .076	+ .078	+ .080	+ .082	+ .084	+ .086	+ .088	+ .090	+ .092	Inch.

TABLE VII.—*Reduction of barometric readings to the freezing-point—Add.*

+ 1° to + 28°

Attached thermometer.	22	22.5	23	23.5	24	24.5	25	25.5	26	26.5	27	27.5	28	28.5	29	29.5	30	30.5	31
Degrees.																			
1	Inch. +.054	+.056	+.057	+.058	+.059	+.061	+.062	+.063	+.064	+.065	+.067	+.068	+.069	+.071	+.072	+.073	+.075	+.076	Inch. +.077
2	.055	.057	.058	.059	.060	.061	.062	.063	.064	.065	.067	.068	.069	.071	.072	.073	.075	.076	.077
3	.056	.058	.059	.060	.061	.062	.063	.064	.065	.066	.068	.069	.070	.072	.073	.074	.076	.077	.078
4	.057	.059	.060	.061	.062	.063	.064	.065	.066	.067	.069	.070	.071	.073	.074	.075	.077	.078	.079
5	.058	.060	.061	.062	.063	.064	.065	.066	.067	.068	.070	.071	.072	.074	.075	.076	.078	.079	.080
6	.059	.061	.062	.063	.064	.065	.066	.067	.068	.069	.071	.072	.073	.075	.076	.077	.079	.080	.081
7	.060	.062	.063	.064	.065	.066	.067	.068	.069	.070	.072	.073	.074	.076	.077	.078	.080	.081	.082
8	.061	.063	.064	.065	.066	.067	.068	.069	.070	.071	.073	.074	.075	.077	.078	.079	.081	.082	.083
9	.062	.064	.065	.066	.067	.068	.069	.070	.071	.072	.074	.075	.076	.078	.079	.080	.082	.083	.084
10	.063	.065	.066	.067	.068	.069	.070	.071	.072	.073	.075	.076	.077	.079	.080	.081	.083	.084	.085
11	.064	.066	.067	.068	.069	.070	.071	.072	.073	.074	.076	.077	.078	.080	.081	.082	.084	.085	.086
12	.065	.067	.068	.069	.070	.071	.072	.073	.074	.075	.077	.078	.079	.081	.082	.083	.085	.086	.087
13	.066	.068	.069	.070	.071	.072	.073	.074	.075	.076	.078	.079	.080	.082	.083	.084	.086	.087	.088
14	.067	.069	.070	.071	.072	.073	.074	.075	.076	.077	.079	.080	.081	.083	.084	.085	.087	.088	.089
15	.068	.070	.071	.072	.073	.074	.075	.076	.077	.078	.080	.081	.082	.084	.085	.086	.088	.089	.090
16	.069	.071	.072	.073	.074	.075	.076	.077	.078	.079	.081	.082	.083	.085	.086	.087	.089	.090	.091
17	.070	.072	.073	.074	.075	.076	.077	.078	.079	.080	.082	.083	.084	.086	.087	.088	.090	.091	.092
18	.071	.073	.074	.075	.076	.077	.078	.079	.080	.081	.083	.084	.085	.087	.088	.089	.091	.092	.093
19	.072	.074	.075	.076	.077	.078	.079	.080	.081	.082	.084	.085	.086	.088	.089	.090	.092	.093	.094
20	.073	.075	.076	.077	.078	.079	.080	.081	.082	.083	.085	.086	.087	.089	.090	.091	.093	.094	.095
21	.074	.076	.077	.078	.079	.080	.081	.082	.083	.084	.086	.087	.088	.090	.091	.092	.094	.095	.096
22	.075	.077	.078	.079	.080	.081	.082	.083	.084	.085	.087	.088	.089	.091	.092	.093	.095	.096	.097
23	.076	.078	.079	.080	.081	.082	.083	.084	.085	.086	.088	.089	.090	.092	.093	.094	.096	.097	.098
24	.077	.079	.080	.081	.082	.083	.084	.085	.086	.087	.089	.090	.091	.093	.094	.095	.097	.098	.099
25	.078	.080	.081	.082	.083	.084	.085	.086	.087	.088	.090	.091	.092	.094	.095	.096	.098	.099	.100
26	.079	.081	.082	.083	.084	.085	.086	.087	.088	.089	.091	.092	.093	.095	.096	.097	.099	.100	.101
27	.080	.082	.083	.084	.085	.086	.087	.088	.089	.090	.092	.093	.094	.096	.097	.098	.100	.101	.102
28	.081	.083	.084	.085	.086	.087	.088	.089	.090	.091	.093	.094	.095	.097	.098	.099	.101	.102	.103

TABLE VII.—*Reduction of barometric readings to freezing-point—Subtract.*

+ 29° to + 65°

Attached thermometer.	29	29.5	30	30.5	31
Degrees.					
29	Inch. —.001	Inch. —.001	Inch. —.001	Inch. —.001	Inch. —.001
30	.003	.003	.004	.004	.004
31	.005	.005	.006	.006	.007
32	.007	.007	.008	.008	.009
33	.009	.009	.010	.010	.011
34	.011	.011	.012	.012	.012
35	.013	.013	.014	.014	.015
36	.015	.015	.016	.016	.017
37	.017	.017	.018	.018	.019
38	.019	.019	.020	.020	.021
39	.021	.021	.022	.022	.023
40	.023	.023	.024	.024	.025
41	.025	.025	.026	.026	.027
42	.027	.027	.028	.028	.029
43	.029	.029	.030	.030	.031
44	.031	.031	.032	.032	.033
45	.033	.033	.034	.034	.035
46	.035	.035	.036	.036	.037
47	.037	.037	.038	.038	.039
48	.039	.039	.040	.040	.041
49	.041	.041	.042	.042	.043
50	.043	.043	.044	.044	.045
51	.045	.045	.046	.046	.047
52	.047	.047	.048	.048	.049
53	.049	.049	.050	.050	.051
54	.051	.051	.052	.052	.053
55	.053	.053	.054	.054	.055
56	.055	.055	.056	.056	.057
57	.057	.057	.058	.058	.059
58	.059	.059	.060	.060	.061
59	.061	.061	.062	.062	.063
60	.063	.063	.064	.064	.065
61	.065	.065	.066	.066	.067
62	.067	.067	.068	.068	.069
63	.069	.069	.070	.070	.071
64	.071	.071	.072	.072	.073
65	.073	.073	.074	.074	.075

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TABLE VII.—*Reduction of barometric readings to the freezing-point—Subtract—Continued.*

+ 66 to + 100.

Attached thermometer.	22	22.5	23	23.5	24	24.5	25	25.5	26	26.5	27	27.5	28	28.5	29	29.5	30	30.5	31
<i>Degrees</i>																			
68	Inch. —.074	— .075	— .077	Inch. —.079	— .080	— .082	— .084	— .085	— .087	— .089	— .090	— .092	— .094	— .096	— .097	— .099	— .101	— .102	— .104
69	— .076	— .077	— .079	— .081	— .083	— .084	— .086	— .088	— .089	— .091	— .093	— .095	— .096	— .098	— .100	— .102	— .103	— .105	— .107
70	— .078	— .079	— .081	— .083	— .085	— .086	— .088	— .090	— .092	— .094	— .095	— .097	— .099	— .101	— .102	— .104	— .106	— .108	— .109
71	— .080	— .081	— .083	— .085	— .087	— .089	— .091	— .093	— .095	— .096	— .098	— .100	— .102	— .104	— .106	— .108	— .109	— .111	— .112
72	— .082	— .083	— .085	— .087	— .089	— .091	— .093	— .095	— .097	— .099	— .101	— .102	— .104	— .106	— .108	— .110	— .112	— .114	— .115
73	— .084	— .085	— .087	— .089	— .091	— .093	— .095	— .097	— .099	— .101	— .103	— .105	— .107	— .109	— .111	— .113	— .115	— .117	— .118
74	— .086	— .087	— .089	— .091	— .093	— .095	— .097	— .099	— .101	— .103	— .105	— .107	— .109	— .111	— .113	— .115	— .117	— .119	— .120
75	— .088	— .089	— .091	— .093	— .095	— .097	— .099	— .101	— .103	— .105	— .107	— .109	— .111	— .113	— .115	— .117	— .119	— .121	— .122
76	— .091	— .091	— .093	— .095	— .098	— .100	— .102	— .104	— .106	— .108	— .110	— .112	— .114	— .116	— .118	— .121	— .122	— .125	— .127
77	— .093	— .095	— .097	— .100	— .102	— .104	— .106	— .108	— .110	— .112	— .115	— .117	— .119	— .121	— .123	— .125	— .127	— .129	— .131
78	— .095	— .097	— .100	— .102	— .104	— .106	— .108	— .110	— .112	— .115	— .117	— .119	— .122	— .124	— .126	— .128	— .130	— .132	— .134
79	— .097	— .099	— .102	— .104	— .106	— .108	— .110	— .113	— .115	— .117	— .119	— .122	— .124	— .126	— .128	— .130	— .133	— .135	— .137
80	— .099	— .101	— .103	— .106	— .108	— .110	— .113	— .115	— .117	— .119	— .122	— .124	— .126	— .128	— .131	— .133	— .136	— .138	— .140
81	— .101	— .103	— .105	— .108	— .110	— .112	— .115	— .117	— .119	— .122	— .124	— .126	— .128	— .131	— .133	— .136	— .138	— .141	— .143
82	— .103	— .105	— .107	— .110	— .112	— .114	— .117	— .119	— .122	— .124	— .126	— .129	— .131	— .134	— .136	— .138	— .141	— .143	— .145
83	— .105	— .107	— .109	— .112	— .114	— .117	— .119	— .121	— .124	— .126	— .129	— .131	— .134	— .136	— .139	— .141	— .143	— .146	— .148
84	— .107	— .109	— .111	— .114	— .116	— .119	— .121	— .124	— .126	— .129	— .131	— .134	— .136	— .139	— .141	— .144	— .146	— .149	— .151
85	— .109	— .111	— .113	— .116	— .118	— .121	— .123	— .126	— .128	— .131	— .133	— .136	— .138	— .141	— .144	— .146	— .149	— .151	— .154
86	— .111	— .113	— .115	— .118	— .120	— .123	— .126	— .128	— .131	— .133	— .136	— .138	— .141	— .144	— .146	— .149	— .151	— .154	— .156
87	— .113	— .115	— .117	— .120	— .123	— .125	— .128	— .130	— .133	— .136	— .138	— .141	— .143	— .146	— .149	— .151	— .154	— .157	— .159
88	— .115	— .117	— .119	— .122	— .125	— .127	— .130	— .133	— .136	— .138	— .141	— .143	— .146	— .148	— .151	— .154	— .157	— .160	— .162
89	— .117	— .119	— .121	— .124	— .127	— .129	— .132	— .135	— .137	— .140	— .143	— .146	— .148	— .151	— .154	— .156	— .159	— .162	— .165
90	— .119	— .121	— .123	— .126	— .129	— .131	— .134	— .137	— .140	— .143	— .146	— .148	— .151	— .153	— .156	— .159	— .162	— .165	— .167
91	— .121	— .123	— .125	— .128	— .131	— .134	— .136	— .139	— .142	— .145	— .148	— .150	— .153	— .156	— .159	— .162	— .164	— .167	— .170
92	— .123	— .125	— .127	— .130	— .133	— .136	— .139	— .141	— .144	— .147	— .150	— .152	— .155	— .158	— .161	— .164	— .167	— .170	— .173
93	— .124	— .127	— .130	— .132	— .135	— .138	— .141	— .144	— .147	— .149	— .152	— .155	— .158	— .161	— .164	— .167	— .170	— .172	— .175
94	— .126	— .129	— .132	— .134	— .137	— .140	— .143	— .146	— .149	— .151	— .154	— .157	— .160	— .163	— .166	— .169	— .172	— .175	— .178
95	— .128	— .131	— .133	— .136	— .139	— .142	— .145	— .148	— .151	— .154	— .157	— .160	— .163	— .166	— .169	— .172	— .175	— .178	— .180
96	— .130	— .133	— .135	— .138	— .141	— .144	— .147	— .150	— .153	— .156	— .159	— .162	— .165	— .168	— .171	— .174	— .178	— .181	— .183
97	— .132	— .135	— .138	— .141	— .144	— .147	— .150	— .153	— .156	— .159	— .162	— .165	— .168	— .171	— .174	— .177	— .180	— .183	— .186
98	— .134	— .137	— .140	— .143	— .146	— .149	— .152	— .155	— .158	— .161	— .164	— .167	— .170	— .173	— .176	— .179	— .183	— .186	— .189
99	— .136	— .139	— .142	— .145	— .148	— .151	— .154	— .157	— .160	— .163	— .166	— .169	— .173	— .176	— .179	— .182	— .185	— .188	— .191
100	— .138	— .141	— .144	— .147	— .151	— .154	— .157	— .160	— .163	— .166	— .169	— .172	— .176	— .178	— .181	— .184	— .188	— .191	— .197
	— .140	— .143	— .146	— .150	— .153	— .156	— .159	— .162	— .165	— .169	— .172	— .175	— .178	— .181	— .184	— .188	— .191	— .194	— .197

RULES

FOR

THE GOVERNMENT OF THE UNITED STATES MILITARY TELEGRAPH LINES.

332. The United States Military Telegraph Lines are, by law, in the charge and control of the Chief Signal Officer with respect to their construction, repair, and operation.

333. These lines, owned by the United States, are only subject to the laws of the general government; built for the better protection of immigration and the frontier settlements from depredations, no use can be permitted of these lines that would defeat the object of their construction. The operators on these lines are enlisted men of the Signal Corps, or civil employes who have accepted military discipline; they will not fail to show to military superiors the proper respect and courtesy required by Army Regulations; they will give commanding officers cordial co-operation in transmitting dispatches and in rendering every possible assistance in promoting military operations, and, in no case, will they treat the demands of their military superiors except with the greatest respect.

334. All business of the War Department, its officers and agents, and telegrams authorized by competent authority, and all "Official messages" of the several departments of the government, will pass *free* over United States Military Telegraph Lines. The official character of messages so transmitted must be verified by the addition of the words "Official business" by the sender. The telegraph is only to be used for public business when such is too urgent to bear the delay of the mails.

335. No telegrams will be sent free, except those specially authorized by competent authority and those on public business. When official messages are filed, which have to pass over the wires of a private company to reach their destination, the officer or agent filing such telegrams will mark them "Official business," and sign his name under these words as a certificate that such messages are official.

336. Telegrams should be as concise as possible.

337. *All* telegrams, public or private, will be credited to the line.

338. A competent person to receive messages from the public must be in attendance from 8 o'clock a. m. until 8 o'clock p. m., or such other times as may be directed.

339. Messages for transmission must be written upon blank No. 201. If a case should occur in which this would be impossible, the receiver will apply some paste to one side of said blank, and require the person

presenting the message to attach the same permanently to the face of said blank.

340. All messages presented for transmission should first be carefully read and every letter clearly understood by the receiver. The address should be examined, and, if not deemed sufficient, a more complete one requested, and anything likely to be misunderstood or liable to occasion error in transmission must be made perfectly plain before being passed into the hands of the operator for transmission.

341. Whenever the address of a person presenting a message is not well known, care should be taken to obtain it, and the same should be noted, either in a book kept for that purpose, or upon the message to be sent. As a proper precaution, this should be done whether the message requires an answer or not.

342. The date and time at which the message is received for transmission should, in all cases, be indicated by the receiver conspicuously upon the margin of the communication.

343. (1) In counting the words in all messages the following rules will be observed:

(2) Names of cities and places, when used to designate such cities or places, will be counted as one word; for example: New Orleans, New York, West Troy.

(3) Words connected by a hyphen, as found in Webster's Dictionary, to be counted as one word. Examples: to-day, rail-road, head-quarters, aid-de-camp.

(4) Names of persons and places, when given to things, must be counted according to the number of distinct words in each. Examples: names of steamers—Isaac Newton, two words; Maid of the Mist, four words. Names of hotels—Burnett House, two words; United States Hotel, three words.

(5) When there are prefixes to surnames, such as "Van," "Mac" or "Mc," "Saint" or "St.," "O," "De," as in Van Rensselaer, McGregor, Saint Nicholas, O'Connor, DeWitt, the whole name is to be regarded as one word.

344. The word "collect" will be counted in the check of all collect messages, but no charge will be made therefor.

345. No message must be telegraphed from dictation, or otherwise than from legible copy; which copy must be filed for future reference.

346. Every message telegraphed, whether "free," "paid," or "collect," must be checked at the end with the number of words it contains, and "O. B.," (if on government business) "free," "paid," or "collect," written out in full. If "paid," or "collect," the amount must be stated in the check, with the name or signal letter of the office where paid or to be collected. Thus, on a message paid in Prescott, the check should be, "10 P. 50 paid." If to be collected in Prescott, "10 P. 50 collect," or whatever the signal for the office may be.

347. If a part of the tariff is for "other lines," the amount for "this line" should be first stated, and then the amount for "other lines."

348. Whenever more than one signature is attached to commercial messages, count all initials and names, except the last signature, as a part of the body of the message. All words in commercial messages are to be charged for except the date, address, and name of the signer. This rule applies to all titular affixes, such as "agent," "superintendent," &c. The address and signature must always be counted in government messages.

349. Telegrams tendered for transmission by any officer or agent of the

United States Government, if upon official business, must be treated as government messages, and so checked.

Example :

PRESCOTT, A. T., *July 31, 1876.*

SECRETARY OF THE INTERIOR,
Washington, D. C. :

Arrived here at six o'clock p. m. to-day. Will be ready to leave in a few days. Send supplies here.

JOHN SMITH,
Agent.

28—paid, 84, and 224, government rate.

The tariff on the above message is shown by the check to be 75 cents for the first 25 words and 3 cents for each additional word for this line, and \$2 for first 25 words and 8 cents for each additional word for other lines.

If the above telegram is marked by the sender "Charge to Interior Department," the check should be sent *collect*, thus : 28—collect, 84, government rate. If the telegram is sent at commercial rate, the check should be : 20—paid, \$1.05, and \$4.20; the tariff being 75 cents for first ten words and 3 cents for each additional word for this line, and \$2.50 for the first ten words and 17 cents for each additional word for other lines. The other lines collect their own tariffs.

350. Where messages contain amounts or numbers, require the customer, in every instance, to write them in words, as no figures in the body of a message will be transmitted by this or connecting lines unless paid for. If the sender desires to duplicate the amount in figures they must be counted as additional words, and charged for.

351. Cipher messages, composed of simple English words in ordinary use, will be transmitted at usual tariff rates. All other messages in cipher, whether composed wholly or in part of figures, or arbitrary combinations of letters, or words of any foreign language, when used as a cipher, will be estimated by counting each letter or figure as a word, and charging accordingly.

352. Government telegrams are charged for at the rate of one (1) cent per word for twenty-five (25) words or less for each circuit of 500 miles or fraction thereof (counting all except date and place from). The additional words over twenty-five (25) will be charged for at the rate of one (1) cent per word for 500 miles or fraction thereof; for 1,000 miles or fraction thereof, two (2) cents per word, and so on, increasing at the rate of one (1) cent per word for every additional 500 miles or fraction thereof.

353. Commercial and private messages may be transmitted when the lines are not needed for public use. When filed for transmission at any office on the United States military telegraph lines and addressed to any other office on these lines with which there is direct communication they must be forwarded promptly, and in the order in which they are filed.

354. Messages that necessarily pass over the lines of a telegraph company whose wires connect with the military telegraph lines will be promptly transferred to the agent of such company at the nearest available office to that at which the message originated.

355. When there are two or more connecting lines and the person filing a message, expresses in writing a preference for any one of them, it will be sent as requested, provided that line is working at the time. If it

is not so working, the message will be transferred to the first available line.

356. When no preference is expressed by the sender of a message, it will be sent as far as practicable over the military telegraph line before transferring, provided this course does not delay the message or increase the cost of transmission.

357. Where two or more lines are available at any point of transfer, and no preference has been expressed by the sender of a message, it will be sent by that one which makes the total cost of transmission the cheapest.

358. Where there is no difference in cost and more than one line is available at any point of transfer, messages originating at offices on the military telegraph lines whose route has not been indicated by senders will be divided as equally as practicable between the several lines.

359. When an office is occupied in common by the military line and the several connecting lines, the action of the party filing a message with any one of the several agents will be considered a sufficient indication of a wish that it should be transmitted over the line he represents.

360. A copy of paragraphs 353, 354, 355, 356, 357, 358, and 359 will be kept posted conspicuously in each office upon the military telegraph lines.

361. Whenever commercial or D. H. messages are forwarded to be mailed to destination, collect for postage and add it to the check. The receiving office will affix the required postage and check the amount against the transmitting office. Moneys received for postage will be accounted for on accounts current under "sundry receipts," and moneys paid out for postage on mailed messages will be credited on accounts current, noting thereon the offices ordering the same. Official postage-stamps will be used on official messages ordered to be mailed to destination. Commercial messages ordered to be mailed must in every case be prepaid.

362. If the sender of a message desires to know whether it has been delivered to his correspondent, the required information may be telegraphed direct to him by the operator of the office to which the message is transmitted. In such cases the request must be made, and the additional sum of one-half the cost of ten-word message paid, at the time of sending the original message. The receiver will then add the signal "34," and include the extra tariff in the check, and the delivering-office will thus be notified to telegraph the necessary information promptly.

363. Messages containing profane or obscene language will not be received for transmission.

364. Messages may be exhibited to the senders or receivers upon personal application, or to a third person upon their written order, and they may be allowed to make copies of the messages; but, in all cases, the sender or receiver, or the signature to the order, must be well known or fully identified.

365. No message of any kind shall be taken to send "collect," unless guaranteed by a responsible party, except the same be known to be a reply to a message requiring an answer.

366. Care must be taken in preserving and filing away messages which have been transmitted, in order to make reference thereto easy and expeditious. Each day's business should be kept separate—every message therein filed with a number corresponding to its entry on the record book. At the close of the month each day's business, plainly marked, should be inclosed together, and the same properly labeled. These

packages must be retained at least two years, after which they will be disposed of as the officer in charge may direct.

367. The operator in charge of an office is held accountable, and is responsible to the government for all property and supplies whatsoever in or belonging to his office; for all money received, and for all transactions involving the payment of money in the regular and legitimate business of the office. No operator is authorized, but, on the contrary, is prohibited from contracting any debts or obligations on account of the government, except when authorized by competent authority.

368. Operators are expected and required to prevent loss and waste of stationery, office supplies, line-repair material, fuel, lights, &c., and to exercise the same care of office furniture and other property in their charge, and the same rigid economy in management as would be expected of a prudent business man in conducting his private affairs.

369. Operators may, upon receiving a deposit of money sufficient to cover all expenses, undertake to have messages delivered by a special messenger.

370. The following instructions in regard to *special telegrams to newspapers* originating at offices on the government lines will be strictly observed: In all cases of special telegrams presented for transmission to newspapers at special rates, the manager will, if a proper name is not subscribed to the message, request the correspondent to furnish his name and post-office address, which will be noted on the special telegram; such telegrams will be carefully filed and preserved in the usual manner. In case a newspaper special is brought to an office by a party other than the correspondent and the same is not authenticated by a proper name, the manager will refuse to transmit it and will notify the messenger accordingly. The same rule will be observed in case a correspondent declines to give his name and address. Specials originating with operators in the employ of the government telegraph must be signed with the full name of the operator sending the same, but such specials must not, however, contain any information relating to military affairs, or any comments whatever on the conduct or actions of any person. Special telegrams addressed to a particular newspaper must not be furnished to any other paper without the express order of the sender over his signature. In such cases the regular special tolls will be checked against the receiving office for each paper receiving the special. Telegrams ordering specials will be received at half the regular rates, but no message will be sent for a less sum than fifteen cents. Newspaper specials will be charged for at one-half of commercial rates, but no special will be sent for a less sum than twenty-five cents.

Special or other telegrams will not be received for transmission over military lines reflecting on the operations of a military campaign, or criticising unfavorably the conduct of any officer. This rule does not apply to dispatches which are in the nature of official reports.

371. *Conditions under which private telegrams will be transmitted when special caution is requested by commanding officers.*—Private dispatches may be transmitted over the United States lines only when of a *lawful nature*, and when the lines are not needed for public use. Private telegrams presented for transmission which relate to the movement of troops shall in all cases be refused, unless authorized by the signature of a commanding officer. Whenever special caution is requested by commanding officers, the officer in charge will exercise a special scrutiny in order that no dispatches from private sources giving information of military movements or that appear of a questionable nature, may be sent. At such times messages in cipher or messages that seem preconcerted, un-

less exhibiting the signature of proper military authority, will be submitted to the officer in charge for authority to transmit. The following rules will be strictly observed by all operators and employés. At such times any person presenting a dispatch at any station on the military lines to be telegraphed therefrom, relating to a matter concerning which a commanding officer has requested special caution to be exercised to prevent an improper use of the lines, the sender will be informed (but without offering any explanation) that his dispatch cannot be forwarded to destination until it shall have been examined by the officer in charge and his orders thereon received. Should the sender decline to submit the dispatch for such examination it will be refused transmission and returned. It must be understood that the duty of examining dispatches of a questionable nature, devolves upon the officer in charge of the line alone, and the exercise of that duty by any other person is unauthorized, and no information regarding the contents of such dispatches or the action that may have been taken with respect to them, will be furnished to any person without permission from the officer in charge.

OPERATING DEPARTMENT.

372. Operators and other employés will conform to such rules and regulations respecting working-hours, meal-times, &c., as may be deemed most conducive to the prompt transmission of business.

373. At offices where more than one operator is employed, meal-hours will be so arranged as to have at least one-half the force on hand during meal-time. Absence from duty, without special permission from the officer in charge, will not be allowed.

374. The chief operator at all terminal points will test wires and ascertain the location of any interruption to the circuit, and give directions for making temporary repairs. Operators at intermediate offices will report to and promptly obey any instructions from him, and are expected to use diligence in doing anything required to place wires in working order in the shortest possible space of time.

375. The chief operator will be strictly held responsible for the good condition of the main batteries at all times. They will never be wholly taken down, but cleaned and renewed by sections.

376. It will be the duty of the chief operator, or his assistant, at all main terminal or repeating offices, to keep a daily record of all difficulties, interruptions, or incidents occurring in the working of the line.

377. All messages must be transmitted as they are received. No abbreviations will be used, except in office communications. When periods or other punctuation marks are used, care must be taken to transmit them precisely as contained in the original. A period after the address, dividing the same from the body of the message, must always be inserted. When obscure or difficult words appear in messages, the transmission must be slow and distinct, and if an error is likely to occur, the obscure sentence or difficult word must be repeated after the check.

378. Operators will use extra caution in the transmission of proper names. Write the names slowly, and make double the usual space between the initials.

379. In transmitting telegrams the sending operator will send his private signal immediately after the check of each and every message, and when through sending the receiving operator will acknowledge by the letters O. K. followed by his private signal and office call.

380. In transmitting government messages the abbreviation gov't. will

first be sent, and in the check the abbreviations G. R. will follow the amount paid or collect.

381. Words containing spaced letters, like C. O. R. Z., &c, should be transmitted with caution. Make such letters plain, separate, and distinct.

382. Before opening the key, adjust the relay carefully, particularly in wet weather, to make sure that some other office is not using the line.

383. In working with inexperienced operators, write slowly and plainly, and be sure that the message is understood.

384. Operators must never guess at a word; better have it repeated many times than make a mistake.

385. No message will be considered as having been properly received, and no operator will allow a message to pass through his hands without first counting the words, comparing the check, and otherwise satisfying himself it is correct.

386. Unless prevented by reason of the wires not working, all messages received during the prescribed office hours must be cleared before the close of business each day.

387. The operators on duty at stations at which meteorological observations are taken must be on hand to take the observations on schedule time, unless prevented by illness or absence on repair duty, and will have their reports enciphered, ready for transmission at the designated times.

388. From stations where meteorological reports cannot from any cause be sent on schedule time, they will be transmitted at the next signal hour, but no report will be telegraphed which is 24 hours or more old.

389. When from any cause reporting stations are prevented from sending their reports to the regular concentrating stations, they will be concentrated and forwarded by any other available route to the Chief Signal Officer.

390. Stations whose reports have not been received at the close of circuit will be reported to the Chief Signal Officer by the concentrating office, adding to the consolidated report the proper cipher words explaining causes of failure.

391. Whenever a message has been received in which an error is supposed to have occurred in the transmission—the number of words not corresponding with the check, or otherwise—the chief operator may, at his discretion, cause the message to be delivered to the party addressed, with a notation thereon, stating that the message is thus delivered, subject to correction afterward. In such cases a copy of the message must be retained, and the utmost dispatch used in securing correction. When the delay is only temporary and not affecting the value of the message, it will not be delivered until corrected.

392. Great care must be taken to avoid the duplication of a message. In all cases of the delivery of the duplicate copy of the message, the word "duplicate" must be distinctly written across the face.

393. Official and military messages have precedence over all others on government lines, except at times set apart for weather reports, during which all business will be suspended until signals have been transmitted.

394. Office messages relating to correction, loss, or anything affecting the value of the message, will have preference over any other private business, and in no case must an office message be destroyed or willfully delayed in transmission. When office messages are needlessly sent or unnecessarily worded, the same will be reported to the officer in charge.

395. The transmission of messages will include the number of the message and the day of the month. The time of the receipt must be noted

by the receiving operator. The name of the place from which the message originates, and its destination, must be written out in full, whether passing through a repeating office or not. The name of the State must accompany the name of place in address, in all cases, except the names of the leading commercial cities in the United States, such as New York, Philadelphia, Boston, Cincinnati, Chicago, Saint Louis, San Francisco, &c.

396. Extraordinary care must be exercised in sending and receiving repeated messages. The original message should be plainly written, and the operator sending it must be certain that it is read correctly when transmitted. The operator who receives it must copy it plainly, and then repeat it back over the same circuit before doing any other business. If the message is to be forwarded beyond the circuit on which it originates, the operator who receives the message (after being satisfied of its entire accuracy) will himself transmit the message over the next circuit, and will not be relieved from the responsibility of such message till repeated back from the office to which he transmits it. A memorandum of the time and circumstances attending the receiving, transmission, and repeating back should be written upon the margin by the operator, and properly filed for reference. Messages will be repeated back from their destination and delivered to the sender, if so desired, at one-half the usual rates. This repetition is required to prevent loss or error.

397. Whenever a "relayed" message, in course of transmission, is stopped at a relaying office, in consequence of the interruption of a wire over which it must pass to reach its destination, and the delay is likely to be of long duration, the office from which it was originally sent should be promptly notified of the fact.

398. To guard against the loss of relayed messages and weather reports, and to locate the responsibility therefor as well as for errors made in their transmission, the originating office will note upon such messages the time and date and the office to which they were sent; and every intermediate office receiving such messages or reports for the purpose of relaying them will keep a complete and accurate record of the same, showing upon each message or weather report the office from which received and to which sent, and the time and date of receipt and forwarding. A separate file will be kept at each office for relayed messages and weather reports.

399. No persons not directly connected with the operating department will be allowed within the operating room. Operators should recognize the necessity of rigid enforcement of this rule, so far as not to invite their friends inside the office. *Strict privacy of all messages must be observed.*

400. Inasmuch as errors, if any, in messages are almost always made by the receiving operator, he will, as a rule, be held responsible for all such errors. He will, therefore, see the necessity of extreme care, and, in all cases where he has any doubt, use the means in his power to remove it.

401. When calling an office, the office calling will sign the office signal at short intervals.

402. When leaving the office temporarily, or for the night, the main line must be cut off from the instrument. This, however, should never be done without examining the switch or cut-off, to make sure that circuit is complete through it.

403. The ground wire at intermediate offices must never be used except in cases of breaks in the wire, and then only long enough to enable an

office to do the business in hand, after which it must be instantly removed, first notifying the end office.

404. The ground wire must never be used as a protection against lightning. During heavy storms the main wires should be securely cut off from the instruments.

405. The official correspondence over the wires between operators and other employes of the lines must be limited to matters of an urgent nature, and that will not bear the delay of the mails. Use the mail for all matter that will not suffer by the delay.

406. When any message entitled to be transmitted free of charge is to be sent, the reason for being free should be stated in words following the checks, unless the same be well known. When this requirement is not observed, or when the reason for being sent free is deemed insufficient, the receiver will be held responsible for the usual tariff-charges on such messages. The number of words contained in a free message will be transmitted in the check.

407. The value of every free message *sent* will be computed at the ordinary tariff-rates, the same as if it were a paid message. This check is not to be entered in the regular accounts of the office, but a statement is to be forwarded to the officer in charge, at the close of each month, showing the number of free messages sent by each person, and their aggregate value, computed as above directed. The original messages will accompany the statement as vouchers. Copies of all received free messages will also be forwarded at the same time.

DELIVERY OF MESSAGES.

408. A copy of the message to be delivered must in all cases be retained in the office. There will be free delivery of messages within the limits of the town in which an office is located. At offices where there is no messenger, telegrams will be delivered by the operator in charge or his assistant.

409. All messages received for delivery should be carefully read, to ascertain if an answer is required, and if requiring an answer, diligent effort should be made to obtain it. The word "answer" or "reply" must be plainly marked upon the envelope, and the messenger be required either to obtain the answer or return to the office a sufficient reason, in writing, for not obtaining it. If no answer is returned, the operator will write the reason therefor in the delivery register for future reference. Messengers must in all cases be supplied with blanks No. 201, on which answers can be written.

410. A receipt must be obtained for every message delivered, which must be carefully kept for future reference, and the time of delivery entered thereon. In case the person addressed cannot be found, the reason, in writing, must be given by the messenger, and the facts investigated by the operator. The messenger must in no case be allowed to enter messages in the delivery book, nor to write the reason for non-delivery upon the message itself; this must be done by the operator.

411. In order to facilitate the delivery of messages after business hours, business men and others likely to have messages should be requested to name in writing the place at which they wish their messages delivered, other than at their place of business. Whenever messages cannot be delivered, in addition to notifying the office from which it was sent, notice should be sent through the post-office to the person addressed; but the message itself should be retained in the office until the close of the month, when copies of all undelivered messages, whether paid or

collect, will be made and sent to the officer in charge with monthly report.

412. In all cases follow strictly the direction in messages as to place of delivery. If, however, a message addressed to a person at his place of business is received after such place of business is closed, it may be delivered to him at his residence; but, unless delivered to him personally, a duplicate of the message shall be delivered at his place of business the next day. In case of non-delivery, or where an answer cannot be obtained to a "44" (answer immediately) message, the reason, in writing, must be given by the messenger to the operator, who will notify the office from which the message is received, and will also make a record of the same upon the envelope of the undelivered message.

413. Where prompt answers are not obtained to messages it proves, in nine cases out of ten, to be the fault of the party to whom the message is addressed, and it is not proper that the line thereby be subjected to the expense of office correspondence. Therefore, when the lines are in their usual good working order to the place where the messages are addressed, and the sender desires any information relative to delivery or answers, they are to be charged ordinary commercial rates for office messages. It is desirable that the senders should send the messages of inquiry in their own names, either to their correspondents, or to the operators in charge. If it is ascertained that the line has been in fault, the entire tariff paid for the original message and subsequent correspondence relative thereto will be refunded; provided, however, that the line is not to be considered as in fault if the parties to whom messages are addressed cannot be found.

414. Prepaid undelivered messages must be inclosed separately, having indorsed upon each the reason for non-delivery, and plainly marked "dead messages" upon the wrapper, with the name of the place from which sent, and retained at the office for reference, unless otherwise ordered.

415. Copies of undelivered "collect" messages will be inclosed with monthly reports as vouchers, indorsed with the reason for non-delivery.

GENERAL RULES.

416. For information in relation to rates of tariff, and other matters not fairly understood, operators will apply to the officer in charge.

417. A careful estimate (Form No. 25 C, Telegraph) of articles required for the succeeding quarter must be made with the report for the last month in the quarter for which the office has been supplied, and, accompanying the same report, an inventory of all the property of the office belonging to the government, including office supplies.

418. Operators are prohibited from purchasing stationery and other ordinary supplies, except when specially authorized by the officer in charge. All such articles will be furnished by the officer in charge on proper requisition.

419. All instruments, relays, keys, switches, or parts of the same not in use, and all refuse zinc and copper from main or local batteries, and other property not in use, must be reported to the officer in charge quarterly, at the time of making requisitions for supplies, stating number, kind, and quantity of each.

420. Transfer of any article belonging to the government must not be made from one office to another; nor must any article be sold or disposed of by any operator or other person, without specific directions from the officer in charge.

421. It is indispensably necessary that there should be uniformity in the mode of making out monthly reports. The receipts and expenditures must be carefully classified and entered under the proper heads on the face of the report.

422. The tariff rates should be observed in entering messages in the record book, and not the amount stated in check when it varies from printed tariff.

423. No credit will be allowed in the monthly report for any expenditure which has not been actually paid.

424. No operator is allowed to adjudicate or pay claims for damages arising from the failure or error in the transmission of a message, nor to refund the tolls thereon. Nor can the government recognize claims for damages, except to refund the money paid for messages where the line is at fault.

425. If the message originated at any point not on this line, the connecting office, or the office at which it first reached this line, as well as the office from which it was originally sent, must be promptly notified by telegraph, in order that collection may be made from "other lines." The copy by mail, in such cases, will only be sent to the connecting or repeating office.

426. All telegraphic dispatches transmitted over the wires must be regarded as in the care and trust of the government, and cannot be revealed without proper authority; enlisted men and employes are therefore prohibited from giving any information to any person concerning any dispatches sent from or received at any station upon the military lines, or permitting any examination to be made of the records or message files in their charge, except by inspecting officers of the Signal Corps, or by persons having authority from the Chief Signal Officer, or the officer in charge of division.

427. The printed blank forms must be used only for the purpose for which they are especially designed.

428. Information must in no case be given to persons, not clearly entitled to receive it, concerning any message passed or designed to pass over the wires.

429. Operators are prohibited from giving copies of sent messages, or written statements relating thereto. All such cases should be referred to the officer in charge.

430. Vouchers for pay of enlisted men on duty as operators will be forwarded monthly to the Chief Signal Officer of the Army, Washington, D. C., in time to reach there by the 20th day of each month, except the pay accounts of civilian operators, who will send them to the officer in charge of the line.

431. Bills for office rent, fuel, &c., will be sent to the officer in charge at the end of each month.

432. Messages of the different departments of the government, originating at Western Union or other telegraph company offices, and passing over U. S. telegraph line, should be additionally checked "O. B. government line."

433. *Night or half-rate messages* will be accepted by offices rated in Western Union and other telegraph companies' tariff books as government offices at "half-rates" on Western Union and other telegraph companies' line, and "full rates" on government lines.

434. Enlisted men and other employes of the line will forward direct to the Chief Signal Officer only such communications as relate to the meteorological work of their stations, and vouchers for pay and commutation.

435. Officers in charge of telegraph divisions will not permit the use of telegraph instruments, or battery, or line material for any purposes other than those directly connected with the operations and maintenance of the lines in their charge.

436. (1) To secure the greatest measure of usefulness and efficiency of these lines for military purposes, the following rules will be strictly observed: Enlisted men and employes in charge of stations (not at a military post), are hereby directed to promptly communicate to commanding officers of posts or cantonments nearest to, and on each side of their stations, any information coming to their knowledge regarding hostile Indians, and to transmit to them all reports brought to a station by scouts, or other persons, respecting Indian raids or depredations committed upon settlers.

(2) To enable commanding officers to determine the degree of importance to attach to such reports, operators will state with the utmost particularity how the information thus communicated was obtained, the nature and extent of the depredations and the place where committed; whether the depredations were by Indians or white men, and, if Indians, the band or tribe to which they belong, the number in the party, and the direction whence they came and towards which they were traveling.

(3) To be of value in military operations it is indispensable that information of this character should be communicated with the least possible delay, and to this end any operator transmitting important military dispatches from official sources or on his own motion, will, in calling the desired office, use the signal "39," which signal will be understood as commanding immediate suspension of all other business until the dispatches in hand have been transmitted.

(4) The signal "39" is intended for the use of the officer in charge, and its use by the operators is expressly forbidden, except in cases of great emergency, as before provided, and when public interests would suffer by delay.

(5) The operator sending, under this signal, military dispatches, as also all operators receiving them, will consider themselves as constantly on duty, and *remain within sound of their instruments until the emergency necessitating its use has passed, and of the termination of such emergency the military commander present on the line will be the judge.* When any operator thus on duty shall have been notified that his attendance is no longer required, he will promptly inform all the others of the fact, but such notification must not be taken as excusing any of them from attendance during the prescribed office hours without the authority of the officer in charge.

(6) The foregoing instructions are intended mainly for the guidance of operators on duty at telegraph stations *away* from military posts, but must not be understood as authorizing *any* operators to communicate to military commanders any information which may come to their knowledge through official dispatches sent or received by them, or which they may hear passing over the wires, or from rumors respecting Indian operations or movements of troops which may be current at a military post. In such cases it must be assumed that commanding officers will themselves communicate such information to other military commanders should they deem it proper or necessary to do so.

INSTRUCTIONS FOR KEEPING, MAKING UP, ADJUSTING, AND TRANSMITTING MONTHLY ACCOUNTS.

437. Each manager will render an account current (Form 29, Telegraph), showing the earnings of the office during the month. This re-

port will be made in triplicate, one copy to be retained at the station and two copies forwarded to the officer in charge, not later than the *third* day after the end of the month for which the account current is rendered, and be accompanied by proper vouchers, supported by memorandum bills for authorized expenditures. Balances shown on accounts current will be forwarded therewith by registered mail, unless otherwise specially ordered by the officer in charge. If the receipts of the office are insufficient to pay all authorized expenditures, the proper receipted vouchers for the latter will be forwarded and credited on the account current, and the "balance due to the office" will be shown thereon, which, on receipt and examination and approval of the account, will be remitted to the manager by the officer in charge.

438. A check report (Form 35, U. S. Telegraph) will be forwarded with the account current, on which will be entered separately for each station the total amount of business for "this line" and "other lines" done with each office during the month. Under the heading "This office checks other offices" will be entered opposite each station the total amount of tolls for "this line," and "other lines" checked against each for telegrams received "paid" or sent "collect" from the office making the check report; and similarly the latter office will enter under the heading "Other offices check this office" the amount due for telegrams sent "paid" to, and received "collect" from, other offices. The information called for on the back of the check report will be carefully furnished. One copy of the check-report will be retained at the station.

439. All messages must be carefully sorted for each day, and those for each office entered in the telegraph register by themselves, and the amount for each office footed by itself. The amount for each "paid" message sent and each "collect" message received will be entered in the register in the column "Local cash," and also in the column headed "Other offices check," and the tolls for "this line" and "other lines" embraced in the total will be entered under its appropriate heading. Messages received from other offices "paid" or sent to other offices "collect" will be entered under the heading "This office checks other offices," and the amount for "this line" and "other lines" stated in its appropriate column. The total footings of the daily business done with each office, as shown by the telegraph register, will be posted to the check ledger, and at the end of the month the daily entries in the latter will be added together and the total entered on the check report against the name of each office. Thus, if according to Tucson report, Yuma should check Tucson "For this line, \$40; for other lines, \$20," and Yuma checks Tucson the same, it may be presumed they are right.

440. Messages addressed to points on other lines will be checked against the office on *this line* at which they are transferred. Transfer offices will not be checked with other line tolls for messages received paid, or sent collect to offices on other lines. In both these cases the military line tolls only will be checked against the transfer office.

441. All messages not entitled to be sent free under frank, or as "official business," must be prepaid, unless guaranteed by responsible parties.

442. Whenever messages are ordered to be forwarded by mail, the operator in charge will collect, in addition to the regular charges, the amount required for postage. Moneys received on account of mailed messages, or for special delivery charges, must not be included in the "Telegraph receipts," but accounted for on the account current, under "Sundry receipts," indicating the offices at which messages were ordered to be mailed or special delivery charges to be paid. The receiv-

ing office will take credit on the account current for the total amount of postage paid on mail messages or for special delivery charges, indicating the offices ordering the same.

443. The transmitting office is responsible for the charges on "collect" messages, unless the message is in answer to a paid message received, in which case it is the duty of the operator in charge sending the message to which an answer is desired, to require the sender to guarantee the charges on the answer, should any be sent.

444. The charges on "collect" messages should be collected on delivery. In case payment is refused, the receiving office will at once notify the transmitting office by telegraph, and the latter will collect the charges from the party sending the message.

445. An office having sent a "collect" message, on which payment has been refused, will, under no circumstances, request that it be not checked, but the message must be entered upon the books of the sending and receiving offices, precisely as if the charges had been collected, the operator in charge of the receiving office taking credit on his account current for the amount, and filing herewith a statement of uncollectible messages (Form 43, U. S. Telegraph), accompanied by a copy of every uncollect message, and copy of the office message notifying the sending office of the failure to collect. The office receiving a collect message, on which it has, after diligent effort, been unable to collect the charges, *must*, in order to be allowed credit therefor, *show that the sending office was duly notified by telegraph* that the message was uncollectible. The transmitting office will then collect the charges from the sender of the message, and account for the amount on his account current, under "Sundry receipts," filing therewith a statement of guaranteed messages (Form 44, U. S. Telegraph), enclosing a copy of each message with the latter. Uncollected press reports will be treated in same manner.

446. A rigid compliance with the foregoing instructions and the notes on the various blank forms must be observed, and the utmost care taken that accounts current and accompanying papers are correct and formal in every particular before leaving the station.

447. Immediately on receipt of an error sheet (Form 34, U. S. Telegraph) at a station, the operator in charge thereof, whether he was on duty at the station during the period referred to in such error sheet or not, will at once forward by mail to each office, with which a deficiency is shown to exist, a postal error card on which will be entered the total amount of business done each day between his own and the disagreeing offices during the month to which the error sheet refers.

448. The operator in charge receiving an error card will without delay compare the daily record of business shown thereon with his check ledger and message register and note on Form 36, the dates on which discrepancies occur, and show by copies of the messages exchanged on those dates that the amounts checked against the office on such dates are correct. This form, with copies of messages and any other information necessary to its explanation, together with the error card, will be returned to the office from which it was received; and the latter, after receiving replies from all disagreeing offices, will, if he be responsible for the deficiencies, remit to the officer in charge the amount due, forwarding at the same time all papers relating to the error sheet in question. If the operator in charge, then in charge of the station, be not responsible for the deficiencies, the papers will be forwarded to the officer in charge, with a statement showing to whom the errors are properly chargeable.

449. If the operator in charge receiving an error card finds, on comparing the statement of business shown thereon with his records, that he has *overchecked* the office sending the same, an acknowledgment, stating particularly how the overcheck occurred, will be forwarded to the manager, returning at the same time the error card. Acknowledgments must be written on letter paper and signed with the full name and official designation of the operator in charge making them.

450. The error sheets are made up from the check reports of stations received at the office of the officer in charge, and no alterations will be made thereon by operators in charge; but the discrepancies shown must be accounted for either by satisfactory explanations or remittances. In returning the error sheet to the officer in charge, the manager will note in pencil opposite each station under the heading "Explained" or "Paid" the several amounts covered by remittances or explanations.

451. Error sheets, Form No. 34, U. S. Tel., must be returned to the officer in charge, with explanations or money to cover the deficits, with the least possible delay after their receipt. Where an error sheet is unduly delayed through the negligence of managers to reply to error cards, the fact will be reported by telegraph to the officer in charge.

452. The foregoing instructions will be carefully observed, and operators in charge are enjoined to exercise the utmost care to see that the statements submitted with error sheets in explanation of deficits are clear and explicit and conform strictly with the records of the office.

453. The officer in charge will forward to the Office of the Chief Signal Officer with his account current, each month, all papers pertaining to settling these check errors and overchecks, as vouchers explanatory to the abstract.

454. On the third day after the end of the month for which the accounts are due, enlisted men and employes in charge of regular telegraph stations will forward, by registered mail, to the officer in charge the following papers:

2 Copies of account current.

1 Copy of check report.

In case there are any "uncollect" or "guaranteed" messages to report, they must be accounted for on the proper forms, and the total amount of each debited or credited, as the case may be, on the account current for the month in which such uncollect or guaranteed messages were transmitted.

455. The account current must be accompanied by proper receipted vouchers for all authorized purchases or expenditures paid at the station during the month. Form 31, U. S. Tel. (2 copies), will be used for purchases and Form 32, U. S. Tel. (2 copies), for expenditures. A receipted memorandum bill must accompany each set of vouchers, giving, in the case of articles purchased, the name, number, and cost of each, and of expenditures, the nature of the services, giving the rate per day and the inclusive dates from and to which person or articles were hired.

In all cases where special authority has been given, directing the payment of money from the funds of a station, a copy of such authority must be filed with the account, and also the receipt of the party to whom the payment was made.

456. Vouchers for the payment of public money must be signed under the hand of the person or firm in whose name they are made. The affix "per," or "by," or the initials of a name to the signature of a voucher renders it inadmissible, unless accompanied by a properly attested power of attorney.

In the case of money paid to a corporation or company, the receipt

will be signed under the hand of the manager, secretary, treasurer, or cashier, and to his signature must be added his title.

457. The sources from whence moneys taken up on accounts current under "Sundry receipts" are derived must be clearly stated.

458. A duplicate of the account current and of each paper accompanying it (except vouchers) must be retained for file at each station.

459. Attention of enlisted men and employés is called to the instructions contained in Signal Service Orders, No. 15, Office of the Chief Signal Officer, dated April 4, 1879, relative to the keeping of telegraph accounts, and the rendition of accounts current, and to Signal Service Orders, No. 27, Office of the Chief Signal Officer, dated June 25, 1879, relative to the adjustment of check errors. A lack of attention on the part of some enlisted men and employés to acquaint themselves with the requirements of the above orders has entailed great delay in the rendition of the accounts of officers in charge, and imposed much labor in returning for correction reports which, had due regard been paid to the instructions given, would have been entirely obviated.

460. The instructions contained herein, together with the orders above referred to, contain all the information necessary to the proper preparation of accounts current, and enlisted men and employés will be expected to render their reports promptly and correctly.

461. Signatures made by mark must be witnessed.

DESCRIPTION OF MAREAN'S REPEATER.

462. (1) This repeater is of the class that works by the sounder-lever making and breaking the main-line current of the opposite circuit, *i. e.*, the one repeated into.

(2) The relay is the ordinary one.

(3) The sounder has in its base five (5) plugs; one (1), at the end of the sounder, is a main-line plug; the four (4) others, on the side, are short circuit plugs.

(4) In this description the main-line plug is called A; the one on the side nearest the end (anvil) of the sounder is A¹, and the others, in order, A², A³, A⁴, respectively.

(5) When plug A is removed the opposite main line is broken thereby; when A¹ is removed the short circuit is broken; in each case an infinite resistance is interposed.

(6) To work as an automatic repeater, take out plug A and put in plugs A¹ on both sides. To work both sides as ordinary relay and sounder, put in plug A and take out plug A¹.

(7) When used as an automatic repeater but one (1) side works at a time.

(8) In this case the current that flows to line through the relays when operator's key is closed is short circuited through the resistance coils of the working sounder when operator's key is open; thus a continued flow of current, first to line, and then in short circuit, takes place through the *silent* relay, causing its side to remain quiescent while the other is working.

(9) The point when this switching of current takes place is called the repeating point, and is that at which the platina bar on the sounder touches the vertical screw-post above it.

(10) Coils A², A³, A⁴ are of 2,000, 1,000, and 500 ohms resistance, respectively.

(11) By adjusting these, the resistance in short circuits can be equal, approximately, to the resistance in the line. These should be made as

nearly equal as practicable, for when this is so an even current flows through *silent* relay while apparatus is working as automatic repeater, and thus a false break effectually prevented at the instant current is changed from short circuit to line.

(12) The presence of the coils A^2 , A^3 , A^4 renders possible this adjustment of resistance, and it is for this purpose they are made part of the instrument. Plug A being taken out breaks the main-line current flowing through the relay on opposite side of instrument.

(13) Thus it is that all the plugs in the base of the sounder influence in one way or another the main-line current actuating the *other* side of the repeater, but have no influence upon the main-line current flowing through the relay belonging to that sounder.

(14) The ordinary method is to use one battery for each repeater. If lines are of equal resistance, they should be connected to battery in a similar way; if they are of unequal resistance, then each should be connected in such manner that the force from battery is directly proportional to the resistance of each circuit; or, in the latter case, two batteries of proportional strength could be used. Care must in all cases be taken to place dissimilar poles opposite each other.

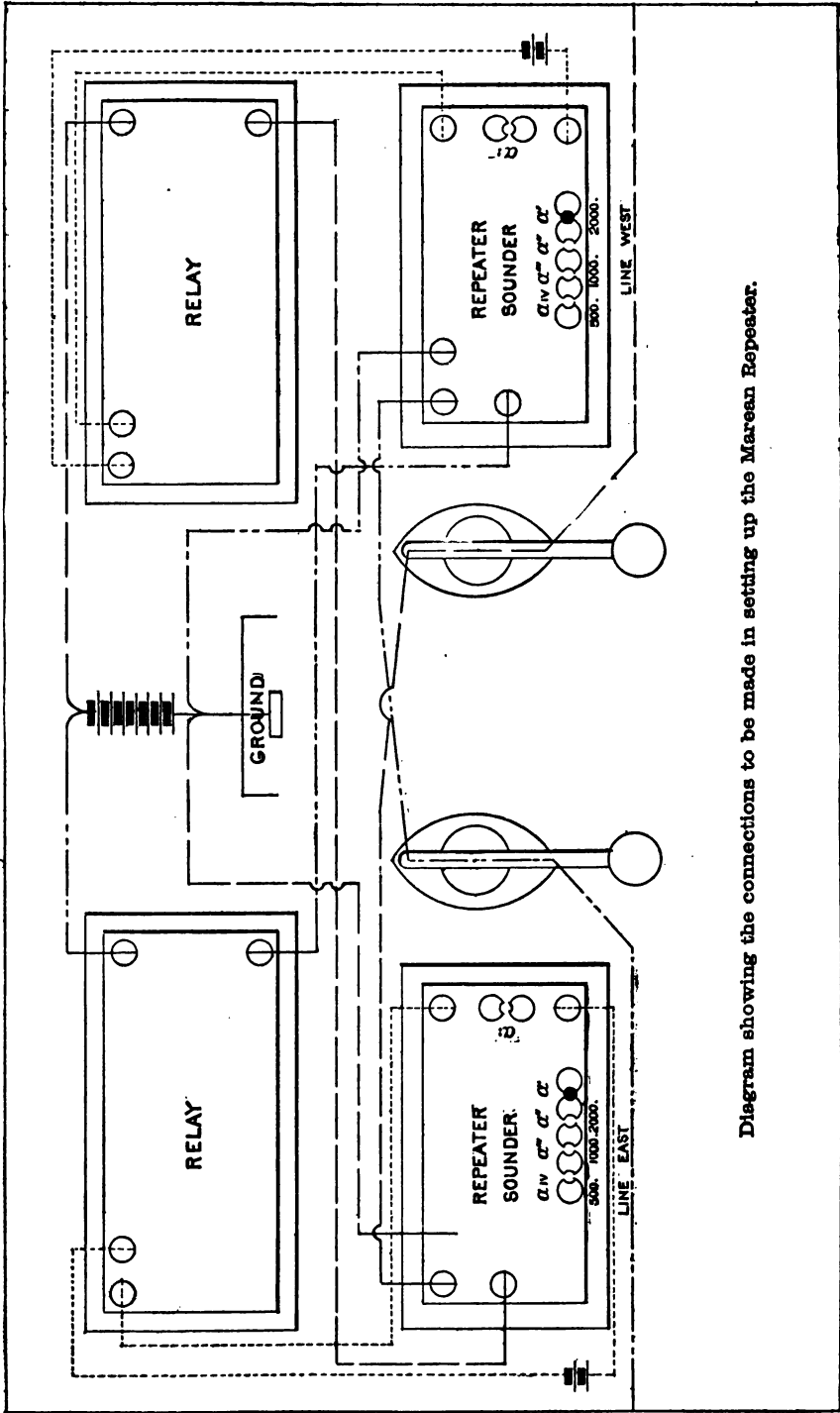


Diagram showing the connections to be made in setting up the Marean Repeater.

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ADDENDUM.

The following will be added to paragraph 2 of § 330 of these instructions:

In using the Dew Point tables select that table, whether main or supplementary, which gives a barometer reading most nearly agreeing with the actual barometer reading at the station. Let the observed temperature of the wet and dry bulb thermometers determine whether the main or the supplementary table is to be used; if the observed temperature of the dry bulb and the observed depression of the wet bulb are found in the supplementary table, use that; if not, use the main table, selecting that one which is computed for a barometric reading most nearly coinciding with that of the observed actual barometric reading.

The number of the table used will be stated on the monthly and weekly forms.

CORRIGENDA.

Page 173 for pp. 3, 5, 9, 11, 15, and 17, read 174, 176, 180, 182, 186, and 188.

Page 197 at temp. $+92^{\circ}$ depression 22° , for 61 read 60.

Page 203 at temp. -24° depression 9° , for 61 read 60.

No. I.

ILLUSTRATION OF CLOUDS.



No. II.

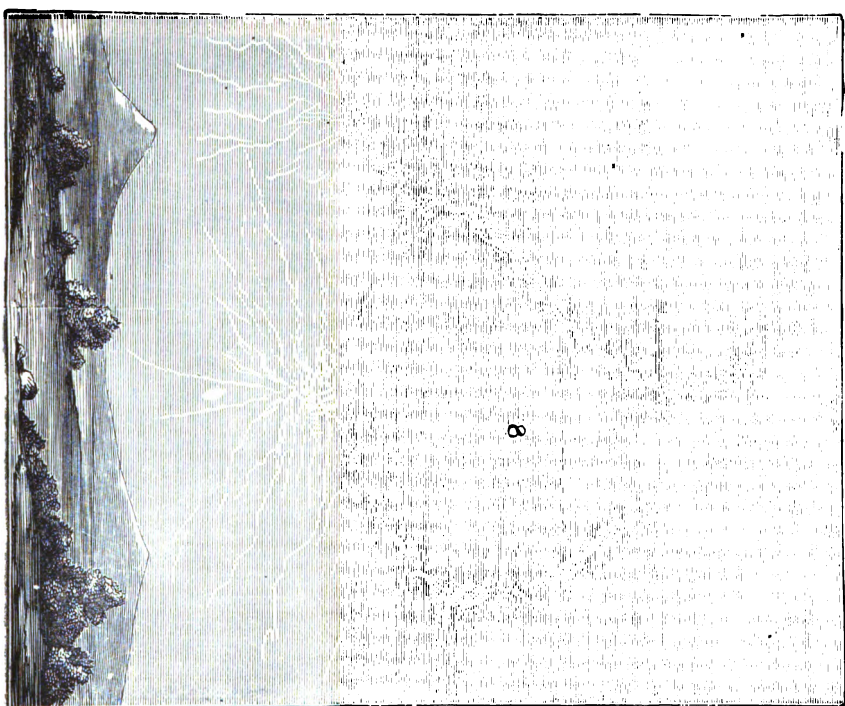
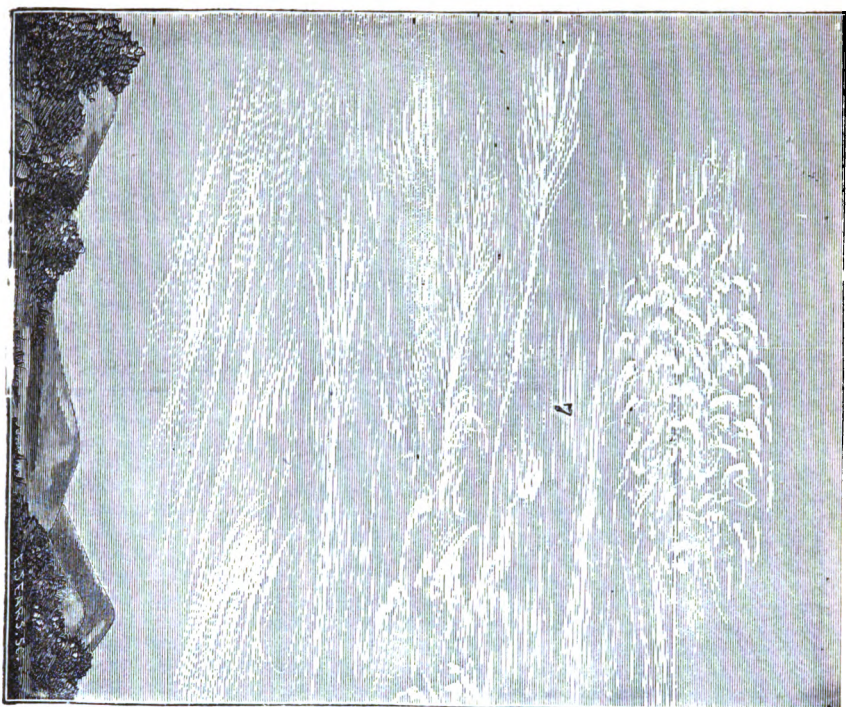


CIRRUS (HOWARD). MORE THAN 6½ MILES IN ALTITUDE.
Figs. 1 and 2, cat's tails; figs. 3 and 4, twisted tufts; fig. 5, plumage; fig. 6, horses' tails.

No. III.

ILLUSTRATION OF CLOUDS.

No. IV.

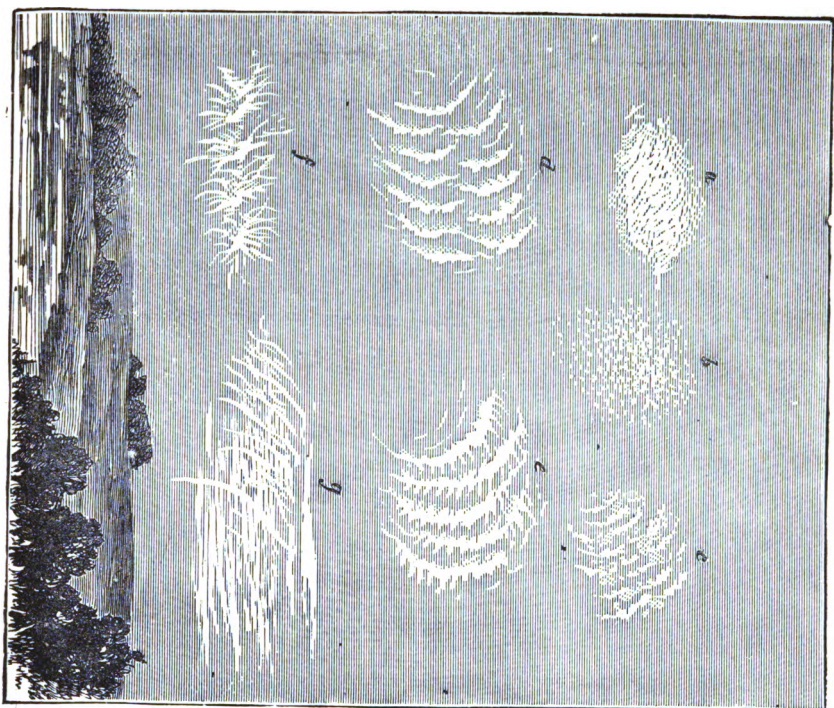


CIRRUS (HOWARD). MORE THAN 64 MILLS IN ALTITUDE.
fig. 7, fine pencils; fig. 8, longitudinal and pinnated bands.

No. V.

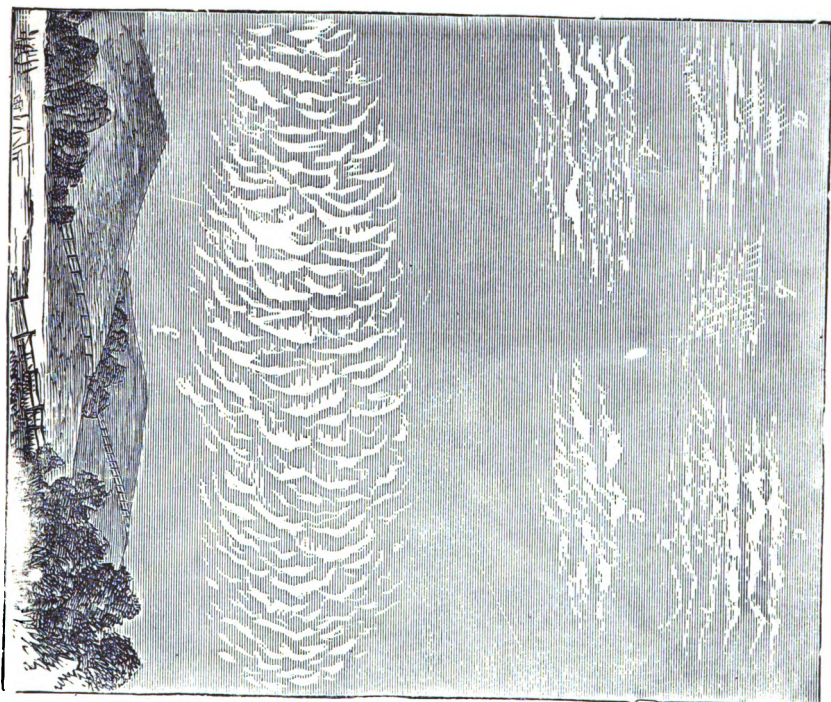
ILLUSTRATION OF CLOUDS.

No. VI.



a, b, c, d, e, partial formation; *f*, perfect formation; *g*, nascent formation.

CIRRO-STRATUS (HOWARD).

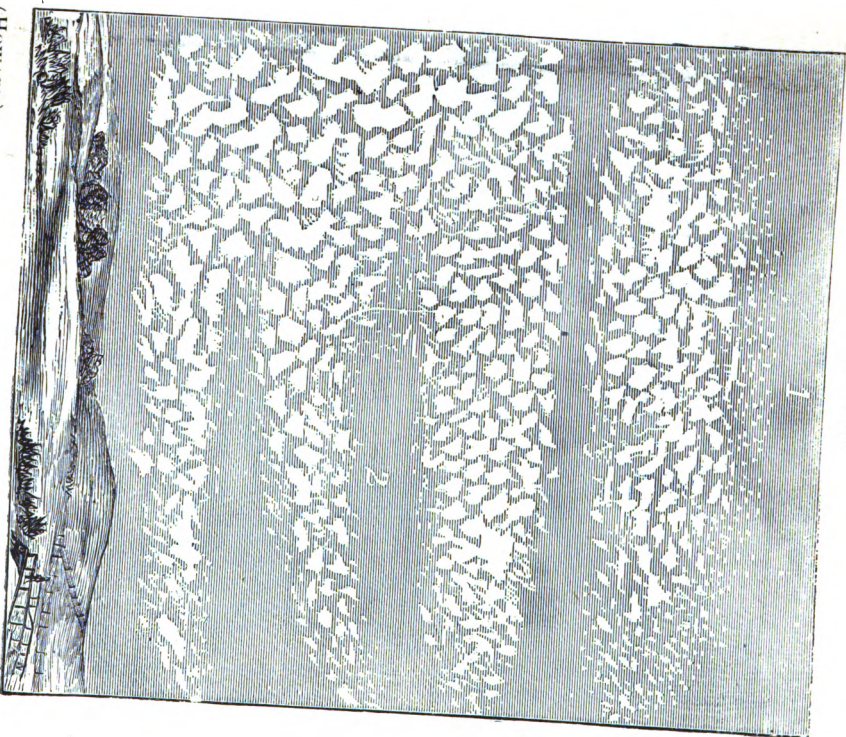
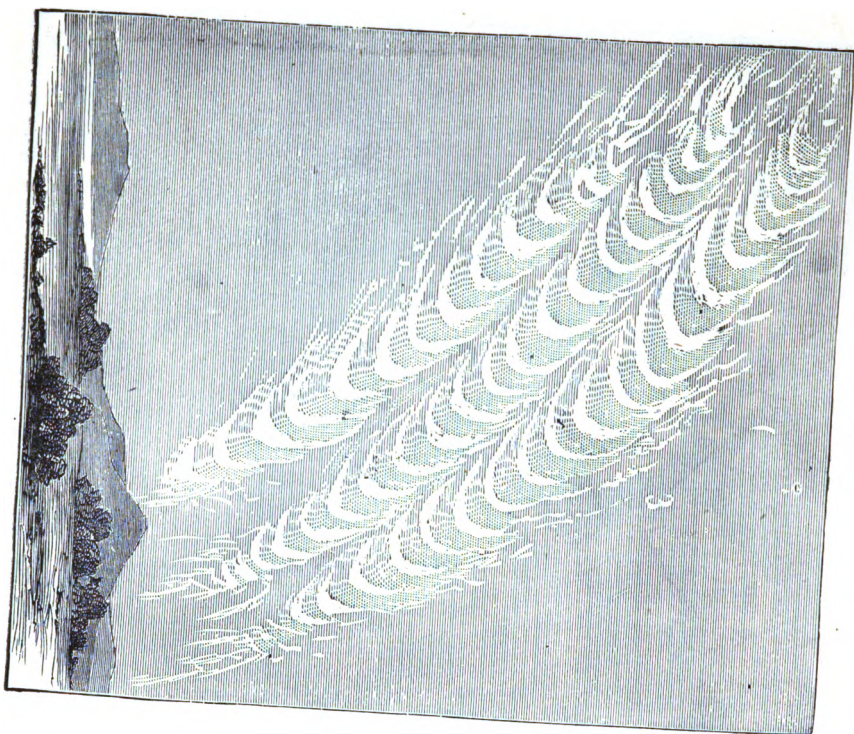


a, b, c, d, e, f, nascent formation.

No. VII.

ILLUSTRATION OF CLOUDS.

No. VIII.



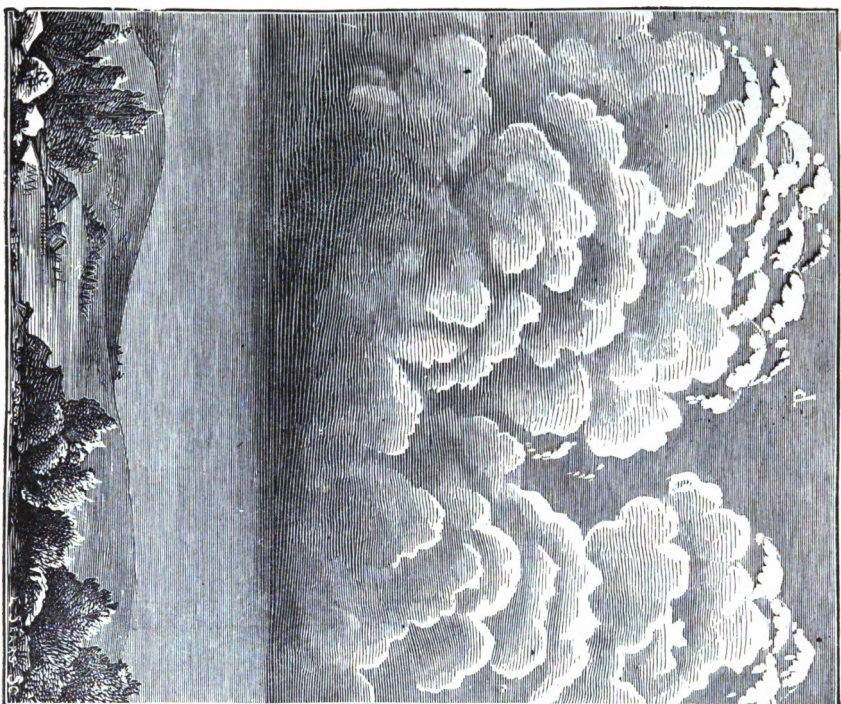
CIRRO-CUMULUS (HOWARD).

Fig. 1, perfect type; fig. 2, bizarre form; fig. 3, irregular form.

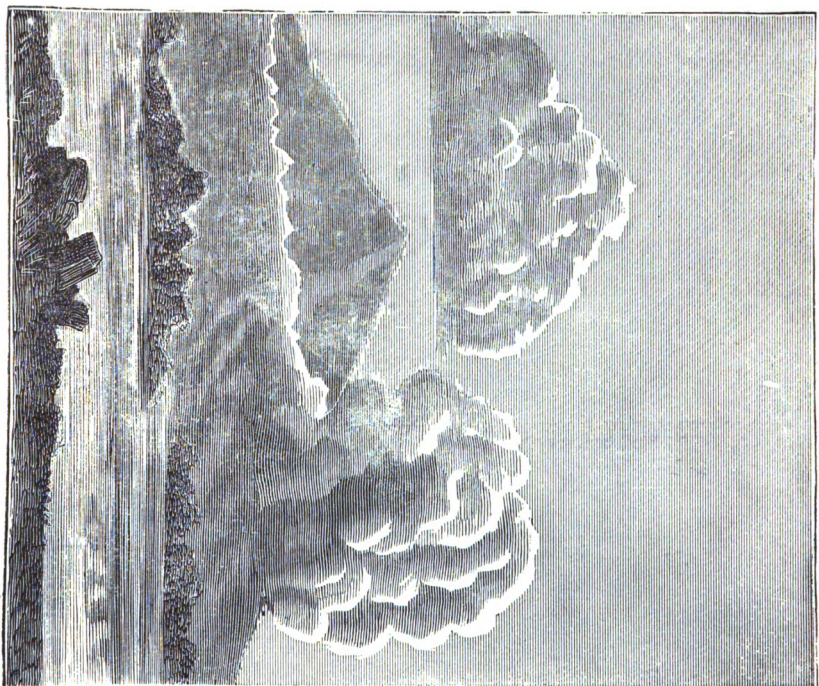
NO. IX.

ILLUSTRATION OF CLOUDS.

NO. X.



CUMULUS OF CUMULO STRATUS (HOWARD).
PERFECT TYPE.

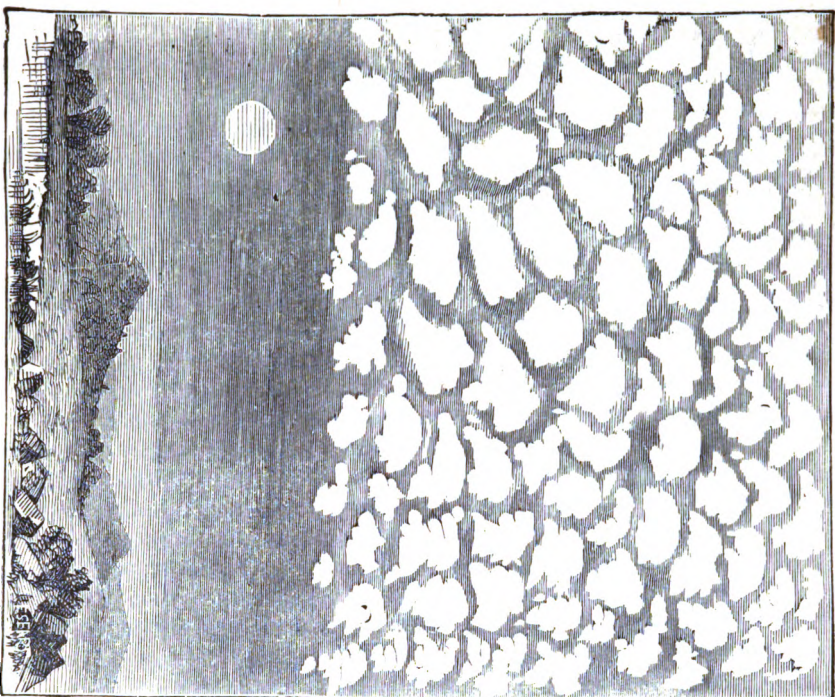


CUMULUS OF CUMULO-STRATUS (HOWARD).
NASCENT FORMATION.

No. XI.

ILLUSTRATION OF CLOUDS.

No. XII.



CIRRO-CUMULUS (HOWARD).
PALLO-CIRRUS (POEY).



NIMBUS (HOWARD).
PALLO-CUMULUS (POEY).

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